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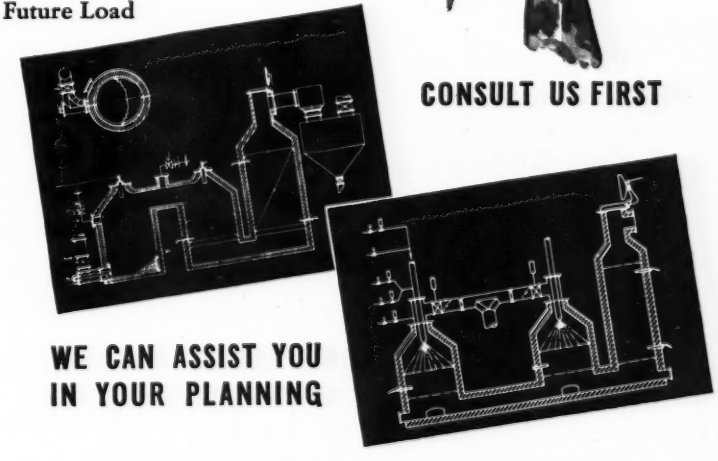

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GAS • *28th Year of Publication*

MAY 1952 • VOLUME XXVIII • NUMBER 5

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ECA NBP

thermally thinking

the editors

New Faces in PAD

Washington

GLENN W. CLARK, newly-elected president of Cities Service Gas Co., Oklahoma City, has been named a member of the Gas Industry Advisory Council by Secretary of the Interior Oscar L. Chapman.

He succeeds S. B. Irelan, whom he also has succeeded as president of Cities Service Gas. Mr. Irelan has been elected president of Cities Service Oil Co. (Delaware).

The Gas Industry Advisory Council advises and counsels the Secretary of the Interior and the Petroleum Administration for Defense on gas matters relating to defense mobilization. It now has 66 members, with 64 having been named by Secretary Chapman last December and two additionally since that time.

The two new members, besides Mr. Clark, include George A. Wilson, president of Interstate Natural Gas Co. Inc., New Orleans, who became a member of the council upon leaving his post as director of the Supply and Transportation Division of PAD in February, and C. P. Rather, president of Southern Natural Gas Co., Birmingham, who was named to the council after leaving PAD as Assistant Deputy Administrator in charge of the Gas Branch on April 1.

Washington

Mr. Rather, whose career as an important—perhaps *the* most important—private industry figure in the public service began a year or so ago, resumes his position with the Southern Natural Gas Co. on leaving his federal post. He was praised warmly by Secretary of the Interior Chapman, who declared, "The organization of the Gas Branch of the Petroleum Administration for Defense and the solving of the complex problems with which you were confronted during its first year of operation were not easy tasks, I know, and you are to be commended on the skill and effectiveness with which you have handled these jobs. I want to express my sincere thanks to you for all that you have done to aid in the defense mobilization program."

In announcing Mr. Rather's new appointment to the Gas Industry Advisory Council, Mr. Chapman added: "I am delighted that Mr. Rather's services are not to be lost completely to me and to PAD. His experience and insight were much too valuable for us to lose lightly."

Howard B. Noyes, vice president of Washington Gas Light Co., has been appointed assistant deputy administrator of PAD to replace Mr. Rather.

Things Are Brighter

Washington

THERE'S NO CONNECTION, of course, but almost simultaneously with Mr. Rather's departure from PAD, the picture on materials for gas pipelines began to grow brighter and brighter. No connection, that is, except that his more-than-a-year of work during a strenuous period had helped to pave the way for the good news.

Six major natural gas pipeline projects with a total estimated construction cost of $215,898,000 have been given priorities assistance for purchase of line pipe for the third quarter of 1952, Secretary of the Interior Oscar L. Chapman has announced. These are in addition to a large number of smaller gas projects that have been given priorities assistance.

Some 169,600 tons of pipe 16 in. or larger in diameter was allocated for third quarter use to the six major projects. An additional 214,800 tons of pipe have been allocated to several hundred smaller projects, including gathering lines, distribution lines, other facilities, and MRO (maintenance, repair, and operations).

Total pipe allocated to date for the quarter is 384,400 tons.

The six large projects given the special priorities assistance are as follows:

1. Extension and looping of the Texas-Ohio system of Texas Gas Transmission Corp. to provide additional supply to present customers.

2. Looping of the existing Texas-California system of El Paso Natural Gas Co. to provide additional gas for California.

3. Augmenting of the system of Interstate Natural Gas Co. to provide additional gas for Baton Rouge, La., industrial plants.

4. Construction of additional facilities into the Houston-Texas City area by Houston Pipe Line Co.

5. Looping and extension of the Southern Natural Gas Co. system for additional supplies to its entire market area.

6. Extension of the Texas-Eastern Transmission Corp.

system to maintain the capacity of the present system.

Small gas operators who were given priorities assistance purchase of oil country tubular goods in the first quarter of the year, but were unable to place their orders, will be permitted to file for new allotments under Order M-46, Direction 2, PAD has pointed out.

Delays at mills reduced deliveries of pipe to M-64 stocks, which are field stocks reserved for use by operators who normally drill eight or fewer wells during a year, NPA explained. As a result, some supply stores could not accept the authorized orders of some small operators.

Meeting this difficulty, PAD now will review applications for new allotments by any of these operators.

Gas Controls May Go

REP. ALVIN F. WEICHEL (R-Ohio) is the first legislator yet to go on record with a public statement against state control of restrictions relating to natural gas during the emergency, and he has done it only because of what he calls a case that is "beyond understanding."

The congressman brought to the attention of his colleagues the fact that a legless veteran of World War II has been denied natural gas service in Elyria, Ohio, by the Ohio Utilities Commission despite the "fact that Ohio leads all other states with reference to the amount of natural gas held in storage and increased its volume from May, 1951, down to March 15, 1952, as reported by the American Gas Assn. and the American Petroleum Institute."

"For what purpose should the Public Utilities Commission of Ohio pile up the greatest natural gas storage in the country, taking it away from legless veterans and

Washington

other hardship cases who simply want natural gas for the purpose of existence?" Congressman Weichel asked his colleagues, none of whom replied.

The legislator introduced a bill to deny exemptions from federal control of gas sales (as was written into the Defense Production Act last year) to states which refuse to "recognize the totally disabled hardship cases and legless persons. . . ."

This is the first—but certainly not the last—instance of public pressure for complete relaxation of controls over natural gas put into effect during the emergency which seemed to be upon the nation last year. With the "stretch-out" in the defense program, and a corresponding increase in steel and other metals, *any* restrictions soon will be difficult to keep in effect. The trend, right now at least, is to throw off *all* controls. It could even upset the Defense Production Act itself.

Overruling OPS

THE OFFICE of Price Stabilization, which is taking it on the chin in many ways right now (not the least of which is its fear of being wiped out of existence, as a result of the President's bungling attempts to pay off labor in the steel seizure controversy), has lost a major case in which it was very interested, although it can hardly be expected that the company involved was satisfied with the results of the case either.

Southern California Gas Co. has been allowed a temporary rate increase of $4,890,000 out of a request for an immediate interim rate increase of $10,008,000. The company originally had applied to the California commission for an increase of $17.6 million in natural gas rates.

Washington

The small amount allowed by the commission was designed to yield a return of 5.45% on net investment, with depreciation deducted.

The OPS entered the case dramatically, opposing any increase, and pointing out that increased income taxes attributable to the Korean war should be excluded from operating expenses because of the extra burden was part of the sacrifice Congress intended the taxpayers to bear during the defense emergency.

However, the commission rejected this contention, pointing out that income taxes must be chargeable to operating expenses under the U. S. Supreme Court decision in the Galveston Case (1922).

Another Behling Case?

IT IS BEGINNING to look as if the Senate Committee on Interstate Commerce is going to "sit on" the nomination of Dale Doty, Assistant Secretary of the Interior, to be the newest Federal Power Commission member.

Nobody knows why—and no senator will be quoted in opposition to the Chapman protege—but no hearings have been set by the committee so far, and none seems in sight. Also, so far as is known, there is no formal

Washington

opposition to Mr. Doty's promotion to the FPC, although many folks would naturally oppose him since Mr. Chapman has sponsored him so long. They say in Washington that it is impossible to be to the left of Mr. Chapman without finding one's self in an Iron Curtain country.

The Senate in 1948 killed another Truman appointee to the FPC—Burton Behling—without ever giving any reason why. The Senate simply refused to act.

technical trends

by guy corfield

Flammable Limits of Gases

THE U. S. BUREAU OF MINES has just issued a new (fourth) edition of the bulletin "Limits of Inflammability of Gases and Vapors." It is Bulletin 503, dated 1952, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at a cost of 40 cents.

Many gas industry men have been familiar with previous editions of this bulletin and will want to have this latest one in their files. It contains exhaustive data on 155 pure combustible gases and vapors and some of their typical mixtures, such as natural and manufactured gas, gasoline, etc. The data are developed in terms of numerous variables such as source of ignition, direction of flame propagation, size and dimensions of containing vessel, pressure, temperature, turbulence, admixture with oxygen instead of air, effect of chemically inert substances, and effect of addition to a flammable mixture of other flammable substances with different limits.

Typical limits of flammability, at ordinary temperatures, with upward propagation of flame in large vessels open at the bottom, for gases and mixtures commonly encountered in the gas industry, are as follows *(the two columns at extreme right of table show oxygen limits below which no mixture is flammable):*

Gas or Vapor	Limits in Air, Per Cent		Nitrogen As Diluent of Air	CO_2 As Diluent of Air
	Lower	Higher		
Hydrogen	4.0	75	5.0	5.9
Carbon monoxide	12.5	74	5.6	5.9
Methane	5.3	14	12.1	14.6
Ethane	3.0	12.5	11.0	13.4
Propane	2.2	9.5	11.4	14.3
Butane	1.9	8.5	12.1	14.5
Methyl alcohol	7.3	36	10.3	13.5
Acetone	3.0	11	13.5	15.6
*Gasoline	1.4	7.6	11.6	14.4
*Natural gas	4.8	13.5	12.0	14.4
*Carb. water gas	5.5	36	—	—
*Coal gas	5.3	32	11.5	14.4

*Approximate.

Trench Backfilling

ELSEWHERE IN THIS ISSUE is an article entitled "Soil Mechanics for Trench Backfilling," which should be of more than ordinary interest as indicating an approach to the understanding and control of an important but somewhat neglected phase of street operations. Second only to the importance of avoiding unnecessary pavement breaking and street excavation would seem to be the backfilling of the ditch so that the surface will not settle or distort either before or after re-paving. The general public resents ruts or humps at temporary backfills, and often the finish resurfacing is not much better after undergoing relatively short periods of traffic weight and shock.

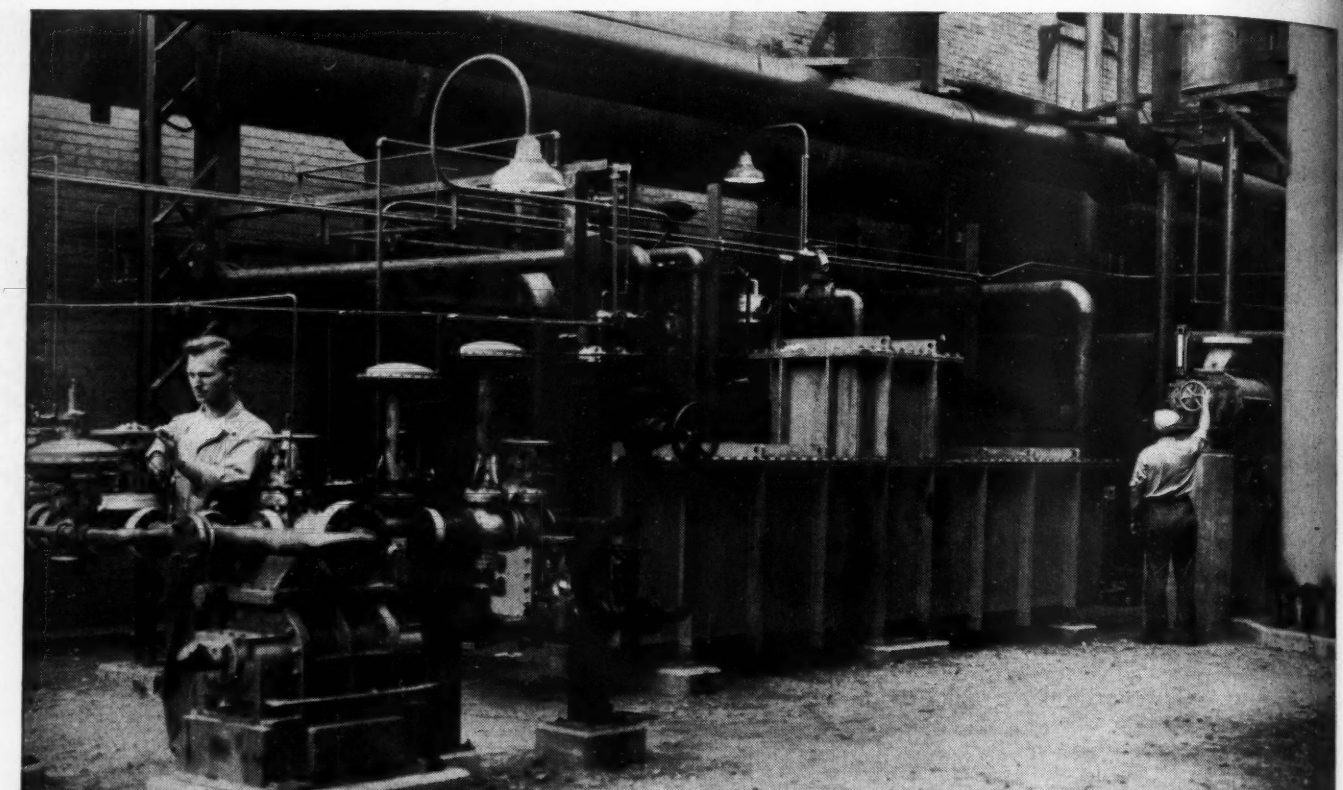
Utilities operating over a large area often have to comply with a wide variety of municipal ordinances controlling backfilling with respect to tamping, flooding, etc., some of which are inconsistent if not contradictory. Some municipalities take a dim view of the effectiveness of their own instructions, and charge as much as twice the initial cost of re-paving because of expectation of having to go back and do the job over again. Even a casual consideration of the annual costs of backfilling and charges for re-paving street excavations, and the associated possibilities of impaired public relations, should emphasize the desirability of further study of this general subject and it is hoped that, as the author states, his discussion will stimulate engineering thinking on the problems.

Tax On Fellowships?

AN ITEM IN THE MARCH issue of *Scientific American* states that a recent ruling of the Treasury Department opens the way for tax levy on the thousands of fellowships awarded annually by foundations, universities, corporations, and government agencies, and the Bureau of Internal Revenue has already decided that some fellowships are subject to income tax. It has been held that a grant is tax-exempt if it is solely for an individual's training or education and "no services are rendered as consideration therefor," but that it is taxable when the recipient "applies his skill and training to advance research, creative work, or some other project or activity." This would seem to open up a wide area for interpretation and manipulation, and to increase the financial problems of students.

For standby service...for peak-load periods...

the Koppers-Hasche Furnace



The Koppers-Hasche Furnace pictured here is now in operation at an eastern utility.

THE Koppers-Hasche Reforming Process and Furnace are the result of 19 years of intensive experimental and development work. The Hasche Furnace is *unique in design*, being a thermal reforming process in which no free lampblack or carbon is produced. Gas is produced by passing a mixture of air and hydrocarbon feed stock continuously through a regenerative furnace.

For utility companies which distribute natural gas—for industrial plants which use natural gas—the Hasche Furnace is ideal for standby service. It is always ready to pinch hit in the event of temporary failure of the natural gas supply. This furnace is also valuable in helping utilities meet peak loads.

Here are some of the principal features of the Hasche Furnace:

INVESTMENT COST IS LOW. Extreme simplicity of process makes initial investment low, per unit of thermal output. Savings are effected not only on furnace cost, but also on auxiliaries. Unit is compact, requiring little ground space. Can be installed outdoors, saving cost of protective housing.

OPERATING COST IS LOW. Units are entirely automatic in operation, requiring minimum of operating labor and supervision. Few moving parts, thus reducing maintenance.

EFFICIENCY IS HIGH. Thermal efficiency is higher than any other gas-producing equipment, ranging upward of 98% with some types of gases.

GAS IS INTERCHANGEABLE. This furnace produces gas that is interchangeable with straight natural gas.

Feel free to write us for further information about the Koppers-Hasche Furnace. Your inquiry will receive prompt attention.

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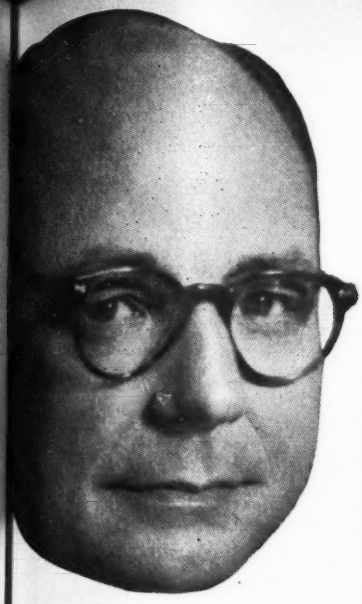
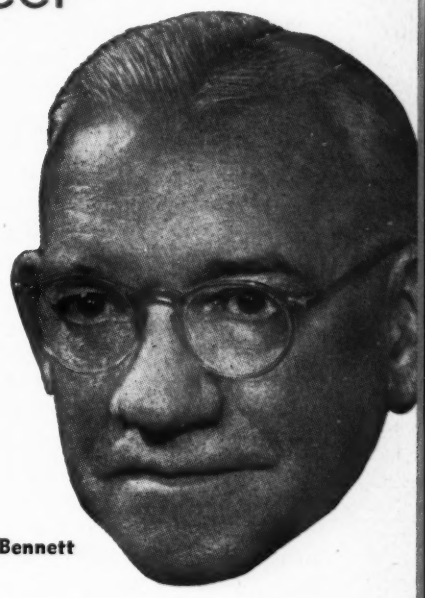


Claude A. Williams

Gasmen Peer Into Future on Safety, Storage, Steel



C. E. Bennett

WHEN representatives of the natural gas industry from all parts of the nation gather in Los Angeles this month—May 12 and 13—for the annual AGA natural gas spring meeting, they could easily spend a busy two days engaging in various forms of self-congratulation. For at this moment, the industry is being hailed as the glamour girl, the rags-to-riches Cinderella of the business world, the sixth largest industry in America.

But it's obvious they won't. There'll be little time for any looking backward (other than a quick summation by the keynoter of the magnificent progress of the industry in the last decade). There are too many of today's and tomorrow's problems that still must be licked.

For a theme, instead of the prosaic "What's Ahead" motto that has been adopted, the meeting might better borrow from the toast of Gordon G. Howie, New England Gas Assn. president and speaker, proposed at the March annual meeting of that group:

Fenton H. Finn

"Hats off to the past, but coats off to the future."

For one thing, there's the problem of safety that needs licking. From wellhead to burner tip, the industry has need of strengthening its position for the good of its public relations. Work on this phase has now progressed from the talking stage to the planning stage, and the safety forum arranged for the meeting—while confined to transmission safety—has taken cognizance of it.

Then there are the almost limitless possibilities of underground storage. Many gas companies that once had little interest in the technology of well operations are now turning their attention to this side of the business. The program, featuring an entire session on the subject, recognizes this fact.

There exist possibilities of improving present methods of pumping gas; based on this assumption, papers will be presented on the related subjects of steam centrifugal compressors and gas turbines.

In essence, it's research that is uppermost in the minds of natural gas men; two items on the agenda have been devoted to this subject.

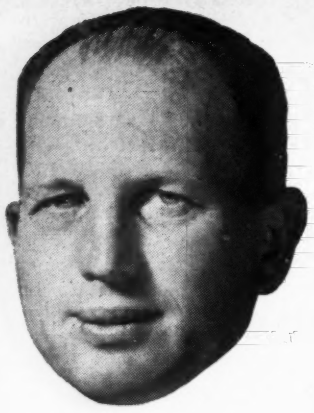
Over the years, the makeup of the natural gas meeting has undergone a metamorphosis. From the days when the department was a younger brother of the manufactured gas department and was formed of a tightly knit group that held its own convention in the spring, the importance of this branch has grown until today it is a large, sprawling group. Having moved in and all but taken over the fall convention, it has tailored its spring program more along the lines of pipeline technology.

Like a transmission company's operations, the convention has been streamlined for the ultimate in efficiency. Two general sessions are scheduled, on each of the two mornings, May 12 and 13. Monday afternoon the transmission section will convene, and on Tuesday afternoon the underground storage session will be called to order.

Getting Rights of Way

First item of business on the first meeting will be observations and comments by Charles E. Bennett, president of the Manufacturers Light & Heat Co., Pittsburgh, first vice president of the AGA, and chairman of the association's natural gas department.

Of particular significance will be the Monday morning talk by B. K. Dunshee of PG&E and H. I. Putnam, Texas Eastern, on "Making Friends—*and Getting Rights of Way.*" The clamor for natural gas and the growth aspects have brought the industry's importance to the minds of those whose property it would cross, and the potentialities of the situation are being exploited in many quarters. Many companies which have met shotgun receptions will listen attentively to the experiences of these two companies.



R. W. Todd

"Facts and Figures on the Association's Natural Gas Research Program," by C. H. Zachry, president of Southern Union Gas Co., Dallas, will follow.

Should any doubts exist in the mind of anyone that natural gas is the nation's fastest growing industry, Charles E. Bennett, presiding officer at the session, will present facts and figures to prove it, in his keynote address.

With the steel situation making the headlines these days, the comments of Alden G. Roach, president of two western divisions of United States Steel, will be followed with interest. Mr. Roach, whose Consolidated-Western division provided the 30-in. pipe for the Biggest Inch line, is lead-off speaker for Tuesday morning's general session, following remarks of F. M. Banks, chairman for the meeting.

Jurisdiction Battle

Still fighting the battle of state-federal overlap in jurisdiction, gas transmission executives will have another opportunity to hear a discussion of their problems by a prominent state public utilities commissioner whose identity has not been disclosed.

The appliance sales angle will be injected briefly into the meeting when Stanley Hobson, former GAMA president, speaks on sales prospects under the intriguing title, "Who Wins?"

"What's Ahead for the Natural Gas Industry" is a topic that could not be omitted from the agenda, and the man chosen to peer into the future, President Claude A. Williams of Transcontinental Gas Pipe Line Corp., operators of the world's longest pipeline, was a logical choice. Mr. Williams will have a wealth of information and opinions on which to base his judgment. Evident all about him are signs of ever accelerating demand. He could look to New England, where in the NEGA convention Keynoter Howie said:

"Estimates of some New England companies which were presented in hearings before the FPC showed that the output of gas in 1957 would be almost *three times* that of 1949, so that in eight years the gas industry of New England would almost triple the output it had taken a century to obtain."

Joe T. Innis

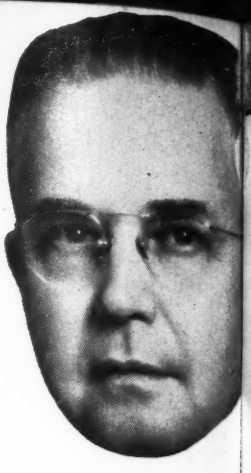
Shirtsleeve Session

Monday afternoon will see a shirtsleeve session, with Joe T. Innis, of Northern Natural Gas Co. and chairman of the AGA transmission committee, presiding over a meeting devoted to pipeline operations. At this session, F. B. Haverfield of Transcontinental Gas Pipe Line Corp. will report on steam centrifugal compressors while J. O. Stephens, Westinghouse, will present the case for the gas turbine. Sandwiched between will be a summing up of "The Industry's Place in the AGA-ASME Large Diameter Meter Tube Research and Testing Program" by E. E. Stovall, Lone Star Gas Co., chairman of the joint committee of the two associations.

Winding up the full afternoon's program will be a forum on pipeline safety, with Frank S. G. Williams, Taylor Forge & Pipe Works, reporting on "ASA, B31, Code for Pressure Piping," and R. G. Strong, Natural Gas Pipeline Co. of America, explaining the new specifications for field welding and radiographic testing of pipelines. A question-and-answer and discussion period will close the meeting.

The entire afternoon on Tuesday will be devoted to underground storage, with Fenton H. Finn of New York State Natural, chairman of the underground storage committee, in the presiding officer's chair. Raymond Todd of Pacific Lighting Corp. and John Riegle Jr. of Southern California Gas Co. will discuss operations of two distinctly different types of California fields—La Goleta, Pacific Lighting's old standby, and Playa del Rey, where gas is being stored in a partially depleted oil zone.

A third district type is the Herscher Dome reservoir in Illinois, a new "bubble" type field, on which Mark V. Burlingame of Natural Gas Pipeline Co. of America will give a progress report.



C. H. Zachry

"Theory of Oil Well Corrosion" will be discussed by Dr. G. H. Rohrback of California Research Corp. and "Statistics for Storage Operations of Storage Fields" will be tabulated by John V. Goodman of Equitable Gas Co.

The formal program will thus close on an appropriate note, with underground storage—the real hope of the glamour industry to build a solid, lasting place in the sun.

* * *

The two-day whirlwind meeting of the department is but one of the magnets attracting gasmen from all over the country to Los Angeles. Many will come early and stay late to engage in nearly a dozen spade-work committee meetings.

Beginning Saturday, May 10, and running through Wednesday, May 14, these committees will gather in conference rooms of the downtown Biltmore hotel:

Underground storage committee, subcommittee on storage lease forms, pipeline flow subcommittee, transmission committee, technical and research committee, laboratories managing committee, special committee on appliance and equipment exhibits, pipeline subcommittee, managing and advisory committee, joint AGA-ASME orifice meters subcommittee, and joint AGA-ASME subcommittee for testing large diameter meter tubes.

F. A. Hough

Program

NATURAL GAS SPRING MEETING

May 12 - 13 • Biltmore Hotel • Los Angeles

Monday Morning — General Session

C. E. Bennett, presiding

Observations and Comments, by C. E. Bennett

Welcome to California

On Making Friends — and Getting Rights-of-Way

B. K. Dunshee, manager, land department,
Pacific Gas & Electric Co., San Francisco
H. I. Putnam, head of right-of-way,
Texas Eastern Transmission Corp., Shreveport

Facts and Figures on the Association's Natural Gas Research Program

C. H. Zachry, president,
Southern Union Gas Co., Dallas

Natural Gas — the Nation's Fastest Growing Industry

C. E. Bennett, first vice president, AGA
President, Manufacturers Light & Heat, Pittsburgh

Monday Afternoon — Transmission Session

Joe T. Innis, presiding

Observations and Comments

Joe T. Innis, chairman, transmission committee, AGA
Vice President, Northern Natural Gas Co., Omaha

Steam Centrifugal Compressors — A Report to the Industry

F. B. Haverfield, superintendent of compressor stations,
Transcontinental Gas Pipe Line Corp., Houston

The Industry's Stake in the AGA-ASME Large Diameter Meter Tube Research and Testing Program

Ernest E. Stovall, chairman, Joint AGA-ASME Subcommittee on Testing Large Diameter Meter Tubes;
Superintendent, gas measurement department,
Lone Star Gas Co., Dallas

The Gas Turbine's Place in Gas Pipeline Pumping

J. O. Stephens, supervisor, development and project engineering, gas turbine development,
Westinghouse Electric Corp., South Philadelphia

Forum on Pipeline Safety

A Report to the Industry on ASA, B31, Code for Pressure Piping

Frank S. G. Williams, chairman, ASA Sectional Committee on Code for Pressure Piping, B31;
Manager of engineering — standards,
Taylor Forge & Pipe Works, New York

A Report to the Industry on the New Specifications for Field Welding and Radiographic Testing of Pipelines

Robert G. Strong, chairman, Joint API-AGA Committee on Oil and Gas Pipeline Field Welding Practices;
Director, engineering,
Natural Gas Pipeline Co. of America, Chicago

Question and Answer and Discussion Period

Frederic A. Hough, vice president,
Southern Counties Gas Co. of California, Los Angeles
Walter H. Davidson, superintendent of operations,
Transcontinental Gas Pipe Line Corp., Houston
Mr. Williams - Mr. Strong

Tuesday Morning — General Session

F. M. Banks, presiding

Observations and Comments

F. M. Banks, president and general manager,
Southern California Gas Co., Los Angeles

Steel for the Pipe of Plenty

Alden G. Roach, president, Columbia-Geneva Steel Division, U. S. Steel Co., San Francisco; president, Consolidated-Western Steel Division, U. S. Steel, Los Angeles

Discussion of Problems Raised by Dual Regulation

Who Wins?

Stanley H. Hobson, president
Geo. D. Roper Corp., Rockford, Ill.

What's Ahead for the Natural Gas Industry

Claude A. Williams, president,
Transcontinental Gas Pipe Line Corp., Houston

Tuesday Afternoon — Underground Storage Session

Fenton H. Finn, presiding

Observations and Comments

Fenton H. Finn, chairman, Committee on Underground Storage; vice president,
New York State Natural Gas Corp., Pittsburgh

Operations of La Goleta Gas Storage Field

Raymond W. Todd, vice president and chief engineer,
Pacific Lighting Gas Supply Co., Los Angeles

Theory of Oil Well Corrosion

Dr. Gilson H. Rohrback, California Research Corp.,
La Habra, Calif.

Statistics for Storage Operations of Storage Fields

John V. Goodman, chairman, Statistics Subcommittee, Committee on Underground Storage; superintendent, production and geologist, Equitable Gas Co., Pittsburgh

Storage of Gas in a Partially Depleted Oil Zone, Playa del Rey Field, California

John Riegle Jr., petroleum engineer,
Southern California Gas Co., Los Angeles

Potentialities of the Herscher Dome As a Gas Storage Reservoir — A Progress Report

M. V. Burlingame, vice president in charge of operations,
Natural Gas Pipeline Co. of America, Chicago

Utilities to Spend $321 Million in '52

● *Seventy-two companies will lay 773 miles of transmission line and 4269 miles of distribution main. Total expenditures are divided among transmission, $78,880,468; distribution, $174,779,957; production, $60,948,794; and other, $7,009,959. The year's construction will increase firm sendout by 832 MMcf daily and will provide 857 MMcf per day for standby.*

Amarillo (Texas) Gas Co. estimates that it will spend $682,630 for distribution this year. The expansion will be in line with the rate of speed of the city's development. An Air Force Base and an Atomic Energy Commission installation near Amarillo have affected growth of the town. New facilities will enable the company to furnish customers with an additional 7.2 MMcf of natural gas per day. Allocation of steel for construction has been sufficient but delayed for 51 miles of line.

Bridgeport (Conn.) Gas Light Co. will apply $600,000 this year to its million dollar 1951-52 expansion program. The company plans to convert to straight natural and the new facilities will increase output by 10 MMcf per day. Ten miles of new distribution mains are to be constructed.

Cambridge (Mass.) Gas Light Co. is beginning an expansion program this year to be completed in 1956 at a total cost of $2,405,100. It will apply $877,100 to the project this year with $410,300 being used for production, $238,000 for distribution, meters, and services, $200,000 for transmission, and $28,800 for miscellaneous expenditures. Two miles of distribution mains and 1.8 miles of transmission line will be laid. Added facilities will make an additional 17 MMcf per day of natural gas available this year and 6 MMcf of manufactured for peak loads by 1956. The company is changing from 951-Btu oil gas to natural. Materials are difficult to obtain.

Central Arizona Light & Power Co., Phoenix, has allocated $967,100 for distribution and will add approximately 65 miles of mains to its system. Construction materials have been adequate. Phoenix and adjacent territory now being served by the company will benefit.

Central Electric & Gas Co., Lincoln, Neb., has allocated $1.2 million for expansion this year, the entire sum to be spent for distribution. New facilities will make an additional 8.8 MMcf of natural gas per day available by Nov. 1. New towns to benefit from the expansion will be Stanton, Neb., and possibly Wisner and Pilger. The company believes sufficient construction materials will be available if a considerable amount of cast iron pipe is used for mains.

Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., will extend its services to fringe communities at the edge of its present distribution system at a cost of $505,500. Of this total, $79,500 will provide for production and transmission, $384,300 for distribution, and $41,700 for transmission. Approximately 7.5 miles of new mains will be added.

Cincinnati Gas & Electric Co. is continuing its $10,800,000 expansion program begun in 1951 and scheduled for completion by 1954. It will apply $3,345,000 to the project this year, using $215,000 for production, $610,000 for transmission, and $2,520,000 for distribution. Eight miles of additional transmission line and 40 miles of distribution mains are to be laid. New facilities will extend service to areas adjacent to Cincinnati. Material shortages and uncertainty as to availability of increased natural gas supplies may interfere.

Citizens Gas & Coke Utility, Indianapolis, has budgeted a $3,212,000 new construction allocation as follows: Distribution, $1,386,000; production, $1,062,000; storage, $508,000; and miscellaneous, $256,000.

City Public Service Board, San Antonio, Texas, will expand its system this year at a cost of $1,816,700. The entire sum will be spent for distribution, including 61 miles of distribution mains. Materials are available.

Coast Counties Gas & Electric Co., San Francisco, has set up a 1952 budget of $1,600,500, of which $361,000 will be allocated for new business, $289,000 for capacity additions, $208,500 for replacements, $228,700 for meters, $403,000 for services, $24,800 for capital tools and equipment, $51,000 for automotive equipment, $14,500 for furniture and fixtures, and $20,000 for land and buildings. The program is part of the continuous expansion of the company's distribution system to serve new customers and does not involve any new territory or major transmission or supply lines. Approximately 100 miles of distribution main will be laid.

Consolidated Edison Co. of New York Inc. will expand its system at cost of $8.5 million this year. An estimated $500,000 of that total will be used for production plant, $100,000 for storage plants, $4.4 million for distribution, and $3.5 million for new business and general improvements. The company will lay about 60 miles of distribution mains. Improved facilities will provide, by July, an additional 10 MMcf of L.P. gas and 15 MMcf of manufactured gas per day for standby service. Presently served areas to benefit from the project are Westchester and Bronx counties.

Consolidated Gas Electric Light & Power Co. of Baltimore is spending $3.3 million for distribution this year and will lay 61 miles of mains. The budget also allows $200,000 for production, making the total for new construction $3.5 million.

Consumers Power Co., Jackson, Mich., has allocated $13 million for extension of its gas distribution and transmission systems to meet an augmented demand for space heating resulting from new business expansion. Expenditures will be divided substantially as follows: $9 million for gas distribution, $3 million for transmission facilities, and approximately $1 million for pumping and regulating equipment. The budget will provide for 100 miles of transmission line and 450 miles of distribution mains, both cast iron and steel. An increase of 290 MMcf of natural gas per day will be available after the improvements are completed.

Dayton (Ohio) Power & Light Co. plans expenditures of $2,670,800 for medium, intermediate, and low pressure facilities. About 70 miles of distribution mains will be laid. The company has half of the required construction materials on hand and the remainder is subject to approval of PAD.

Delaware Power & Light Co., Wilmington, has allotted $650,000 for distribution and will build 16 miles of mains. Approximately $50,000 for production costs will make the year's total expenditures $700,000.

Department of Public Utilities, Richmond, Va., will spend $955,000 this year, including $830,000 for distribution extensions and $125,000 for leak clamping on the existing system. Fifteen miles of distribution mains are to be laid and cast iron pipe will be used in lieu of steel.

East Ohio Gas Co., Cleveland, will apply $6,350,000 to its expansion porgram, which will include 175 miles of distribution mains, during the current year. The budget provides $204,000 for production, $927,000 for storage, $74,000 for transmission, $4,905,000 for distribution, and $240,000 for general expenditures.

Gas Division, Dept. of Public Utilities, Corpus Christi, Texas, will extend distribution mains and develop new subdivisions to serve new customers this year at a cost of $166,338. Eleven miles of distribution mains will be constructed.

Gas Service Co., Kansas City, Mo., is allowing $4.5 million for distribution facilities and will lay 200 miles of mains. The 200 communities currently served by the company will benefit from the new facilities.

Gulf States Utilities Co., Baton Rouge, will spend $440,000 for distribution this year. Of this allocation, $145,000 will be used for completion of loop feeder lines and $295,000 for extensions of mains and services. Approximately 20 miles of mains will be constructed and new facilities will increase natural gas sendout by 1 MMcf per day. The company foresees no difficulty in acquiring sufficient material for normal expansion.

Harrisburg (Pa.) Gas Co. is spending $2,003,200 for new construction this year. The total will cover works improvements, $30,000; distribution improvements, $39,300; office equipment, $16,600; mains, $506,900; customer plant, $200,000; transportation equipment and radio, $30,900; an 800-hp compressor, $220,000; a 3-MMcf holder, $788,000; propane storage tanks, $90,000; and miscellaneous, $81,500. Eighteen miles of distribution mains will be installed and a portion of the main expenditures will take care of sales increase.

Hartford (Conn.) Gas Co. will spend $560,000 in 1952 to expand its system. Of this amount, $210,000 will be used for production; $102,000 for district regulators and pumping mains; and $245,000 for new business mains, services, meters, and installations. Twelve miles of distribution mains are to be constructed. An additional 5 MMcf of mixed gas will be available for daily sendout and, for peak days, an extra 5.5 MMcf will be available. A changeover to 800-Btu mixed natural and manufactured gas is planned. Construction will be dependent upon availability of pipe and equipment.

Indiana Gas & Water Co. Inc., Indianapolis, has signed a new contract with Panhandle Eastern Pipe Line Co. for purchase of an additional 10,000 MMcf of gas per day and also is to receive an additional 15 MMcf from Texas Gas Transmission Co. To provide for the increased supply, the company has set up a $1,917,000 construction budget as follows: Production, $67,000; distribution, $912,000; transmission, $737,000; natural gas field storage facilities, $126,000; autos, work equipment, office furniture, and fixtures, $75,000. Expenditures include the cost of laying 60.7 miles of transmission line and 35.9 miles of distribution mains. The transmission pipeline has all been allocated by PAD and only the applications for gas well pipe are outstanding.

Interstate Power Co., Dubuque, plans a $1,159,000 expansion program, of which $986,000 will be spent for transmission and $133,000 for distribution. Plans provide for 26.5 miles of transmission line and 3.5 miles of distribution mains, making available an additional 2733 Mcf per day of natural gas by summer. The company will convert from manufactured to natural in Clinton, Iowa, and will close a plant manufacturing 1 MMcf per day.

Iowa Electric Light & Power Co., Cedar Rapids, estimates it will spend $50,000 for a new gas-air plant and $272,000 for distribution—a total of $322,000—this year. Expansion will add State Center, Iowa, to the territory served. Conversion from water gas to propane is planned. Most of the construction materials necessary have been acquired.

Iowa-Illinois Gas & Electric Co., Davenport, Iowa, has allocated $2,994,000 for distribution system expansion this year. Of this amount, $1,330,000 will apply to the pressure improvement program begun in 1947 and to be completed in 1953. The program provides for installation of additional feeder lines, regulator stations, and other facilities for load growth.

Iowa Power & Light Co., Des Moines, will spend $1,592,500 as this year's portion of a $3 million 1950-1955 construction program. The current year's budget includes $10,000 for production, $714,500 for distribution, and $868,000 for transmission. The company plans to lay 25 miles of additional transmission line and 22 miles of distribution mains. New facilities will make delivery of an additional 20 MMcf per day possible, but increase in natural gas service will depend upon the amount of gas available as well as the pipe available. Building plans may be curtailed by lack of pipe.

Laclede Gas Co., St. Louis, will spend $7,294,600 for improvements this year. Of this amount, $851,300 will be used for production, $1,184,300 for general expenditures, and the balance for distribution which will include 122.03 miles of new distribution mains, new services, meters and regulators, meter installations, and replacements. An additional 10 MMcf of manufactured and 20 MMcf of L.P. gas will be available for peak loads as a result of the new facilities. Construction materials are available.

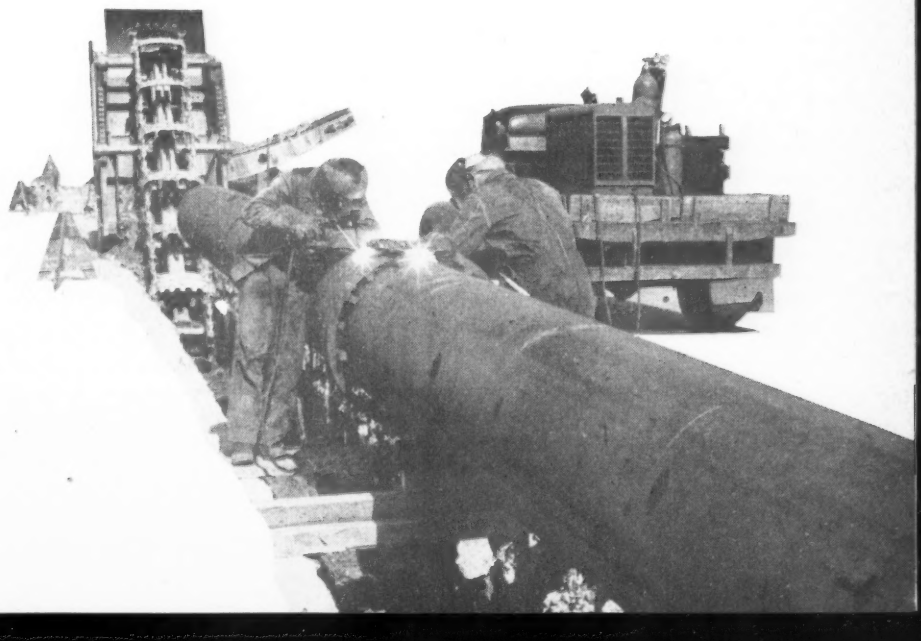
Lone Star Gas Co., Dallas, has a 1952 budget for expansion and improvement throughout its territory of 375 Texas and Oklahoma communities which will total $31,040,400. The sum exceeds any amount spent for construction within a year's time during the company's 42-year history. The budget is as follows: Production, $6,671,000; transmission, $13,535,500; and distribution, $10,833,200. Major projects include the Oak Cliff Service Center being constructed in Dallas and 28 miles of pipeline at the fringe of the city. Shortages of steel and other critical materials may hamper the expansion program to some extent.

Long Island Lighting Co., Mineola, N. Y., will change over from 537-Btu mixed to 1000-Btu natural this year. The conversion and general improvements, including the addition of 90 miles of distribution mains, will cost $4,976,000 to be budgeted as follows: Production, $1,462,000; storage, $153,000; transmission, $775,000; distribution, $2,566,000; and general expenditures, $20,000.

Louisiana Power & Light Co., New Orleans, has a construction budget of $758,000 for the current year. The entirety will be spent to extend gas distribution facilities in the 50 towns now served. The company estimates an increase of 4350 customers, necessitating installation of approximately 35 miles of mains and regulator stations, meters, and services.

Madison (Wis.) Gas & Electric Co. will include in its $214,168 distribution budget $125,026 for gas mains and leak clamping, $6311 for gas pressure regulators and gauges, $56,630 for gas services, $24,360 for customers' meters and meter connections, and $1841 for general plant. Plans provide for 2.8 miles of new distribution mains.

Manchester (N. H.) Gas Co. will channel $130,000 into new construction this year with $30,000 to be used for conversion of water gas sets to high Btu for standby service. The company is changing to natural gas this year and plant facilities for handling it will require a $30,000 expenditure. The balance of the budget will be used for 2.5 miles of transmission mains and 1 mile of distribution extensions. The new facilities will make possible an output of 2 MMcf of natural daily or 2.5 MMcf during peak loads. Materials for conversion and construction are available.



Memphis (Tenn.) Light, Gas & Water Division will improve and extend its distribution system by laying 85 miles of mains; erecting a new distribution building, garage, warehouse, and addition to a pipe coating plant; increasing its automotive equipment; and providing additional gas storage capacity. Total cost of the work will be $3,322,000. The projects are part of a $5,870,000 program to be completed in 1953.

Metropolitan Utilities District, Omaha, has in progress a building program begun in 1947 which will be completed in 1953 or 1954. The current year's expenditure, to be used for governor stations and for ten miles of distribution mains, will amount to $487,500. Controlled construction materials have been approved for the most part and are scheduled for delivery prior to start of construction.

Michigan Consolidated Gas Co., Detroit, has set up an $18.5 million budget to expand its system in areas presently served. Budget items are gas distribution facilities, $13,784,000; manufactured gas production facilities, $736,100; local storage facilities, $4500; natural gas production facilities, $91,400; gas transmission facilities, $208,100; underground storage facilities, $2,687,800; and general facilities, $988,100. Expenditures include the cost of laying 165.3 miles of distribution mains.

Michigan Gas & Electric Co., Three Rivers, Mich., will allocate $337,000 this year for the 1950-54 $2.5 million construction program providing for 150 miles of distribution mains. The lines will serve three new communities—Three Rivers, Three Oaks, and New Buffalo—and will expand facilities for service to Holland, Zeeland, Niles, Buchanan, and Dowagiac. The line will make available for firm service an extra 10 MMcf per day and 15 MMcf per day for peaks.

Milwaukee (Wis.) Gas Light Co. will apply $8.5 million this year to the construction program begun in 1950. Distribution expenditures will account for $7.4 million of the sum, $400,000 will be spent for production and storage, and $700,000 for general plant. Forty miles of distribution mains will be laid to serve new customers and 42 miles of pipe will be used for reinforcement and replacement.

Minneapolis Gas Co. is planning a $6 million general expansion to improve service within the city and to the suburbs. The major allocation will be for services and meters. Two million dollars of the total will be used to construct 70 miles of distribution mains.

Montana Power Co., Butte, has under way a $25 million construction program started in 1950 and scheduled for completion in 1956. This year $3.7 million will be spent, with $2.4 million for production, $400,000 for compression, and $900,000 for distribution. About 50 miles of distribution mains will be added enabling the company to increase natural gas service by 40 MMcf per day. Mining and smelting firms in Butte, Great Falls, and Anaconda will benefit from the new facilities.

Nashville (Tenn.) Gas Co. is spending $750,000 this year for construction of 40 miles of distribution mains within the city of Nashville. The company foresees no difficulty in securing sufficient materials, in addition to present stock, for completion of the work.

North Penn Gas Co., Port Allegany, Pa., will spend $159,427 in 1952 for improvements and replacements throughout the system. Major projects will be distribution system improvements and replacements and extensions for new business, transmission system improvements and replacements, field lines, and new well drilling. Plans provide for 1500 ft of transmission lines, 4.5 miles of distribution mains, and 4000 ft of field lines.

North Shore Gas Co., Waukegan, Ill., will spend $628,000 for new facilities this year. Of this amount, $166,000 will be spent for production consisting of standby additions and operation revisions. Estimates allot $259,000 for routine extensions and new customer mains and services and $203,000 for replacement of mains and operating equipment. The company will lay 16 miles of distribution mains to provide an additional 7 MMcf of L.P. gas per day.

Northern Indiana Public Service Co., Hammond, is undergoing an expansion which will cost a total of $40 million over a period of seven years. The project will be completed in 1957, according to plans. This year's $6.6 million budget will allot 55% for transmission, 41% for distribution, and 4% for production and storage. About 72 miles of transmission line and 84 miles of distribution mains are to be constructed and the company estimates that an additional 67,535 Mcf of natural per day will be available with use of the new facilities. A changeover from 570-Btu mixed gas to 1000-Btu mixed or natural is contemplated.

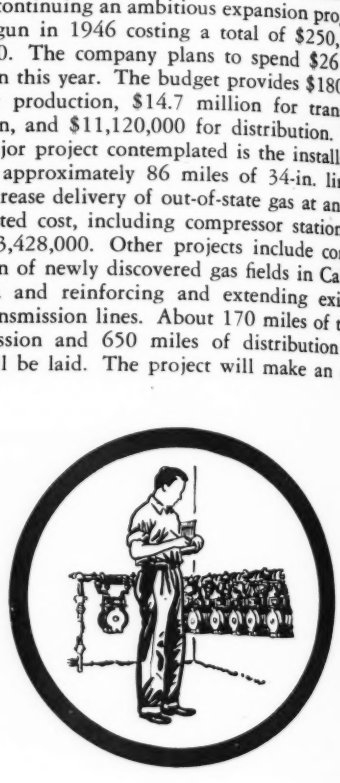
Northern States Power Co., Minneapolis, has allocated $2,290,000 for expansion this year. Production expenditures of $692,000 will be used primarily for a propane air standby plant to be expanded later for peak shaving. Distribution projects, to cost the company $1,598,000, involve a variety of high, medium, and low pressure distribution lines in St. Paul and vicinity where natural gas is available in limited amounts. Plans provide for an additional 25.75 miles of distribution mains and facilities which will make possible an increase of 18.7 MMcf of natural gas per day, dependent upon FPC approval. Steel pipe for certain minor projects has not yet been released by PAD but no other difficulty in acquiring construction materials has been encountered.

Ohio Fuel Ambitious

Ohio Fuel Gas Co., Columbus, has an extensive $23 million construction program in progress this year. The expansion will include $8 million for new pipelines and other transportation equipment, $7 million for distribution improvements, $5.7 million for storage facilities, $1.3 million for new wells, and $1 million for property improvements and replacements.

Oklahoma Natural Gas Co., Tulsa, will expend $593,950 for production this year, $3,295,632 for transmission, $753,205 for gas storage, $4,319,955 for gasoline plants, $2,322,162 for distribution, $583,097 for general expenses, and $53,000 for interest—a total of $11,921,000 for expansion purposes. The company will lay 137.5 miles of new transmission line and retire 157.5 miles of old line. An additional 182 miles of distribution lines will be constructed and the company will add two new communities, Spencer and Noble, Okla., to the territory served.

Pacific Gas & Electric Co., San Francisco, is continuing an ambitious expansion program begun in 1946 costing a total of $250,340,000. The company plans to spend $26 million this year. The budget provides $180,000 for production, $14.7 million for transmission, and $11,120,000 for distribution. One major project contemplated is the installation of approximately 86 miles of 34-in. line to increase delivery of out-of-state gas at an estimated cost, including compressor stations, of $13,428,000. Other projects include connection of newly discovered gas fields in California and reinforcing and extending existing transmission lines. About 170 miles of transmission and 650 miles of distribution line will be laid. The project will make an extra



150 MMcf per day of out-of-state gas available for sendout.

Philadelphia Electric Co. has under way a five-year expansion program to cost an estimated $35 million, of which $6,619,000 will be allocated during the current year. This amount has been budgeted to include production, $2,174,000; transmission, $160,000; distribution, $4,247,000; and general expenditures, $38,000. The company is laying 78.5 miles of distribution mains and 1.7 miles of transmission lines to make available an extra 12 MMcf per day of mixed gas to serve new customers in the existing area. Difficulty in obtaining structural steel and steel plate for plant construction and steel pipe for distribution mains may curtail expansion plans.

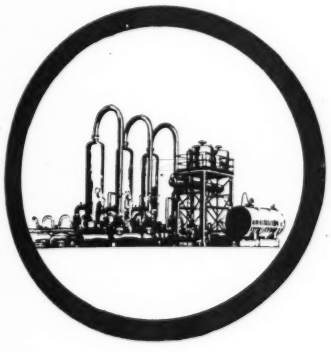
Philadelphia Gas Works Co. is conducting an extensive expansion program to cost $39.6 million. It was begun in 1951 and is scheduled for completion in 1955. The company will spend $7,152,500 this year, with $1,706,000 for production, $5,131,000 for distribution, and $315,500 for miscellaneous expenditures. Addition of 13.7 miles of transmission line and 64.6 miles of distribution mains will raise the capacity for sendout an additional 25 MMcf of mixed gas per day. The northeast section of the city where new home construction is taking place will benefit most by the construction.

Portland (Ore.) Gas & Coke Co. will improve its existing facilities with an expendi-

ture of $725,000 this year. The amount will be divided among facilities for production, $129,000; distribution, $541,000; and general expenditures, $55,000. Construction is being held to a minimum pending the outcome of pipeline company applications to import natural gas from Alberta, Canada.

Public Service Electric & Gas Co., Newark, N. J., plans to spend $24,330,000 for new construction this year, of which $13,215,000 will be used for production and $11,115,000 for distribution, including 69.16 miles of mains. New facilities will increase sendout by 29 MMcf of mixed gas per day by January 1953. The availability of critical materials is not a serious factor, although the delay in procurement may affect construction.

Republic Light, Heat & Power Co. Inc., Buffalo, N. Y., has in progress a $3 million expansion program begun in 1951 and scheduled for completion in 1954. The company intends to apply $775,000 to the project this year, of which $285,000 will be used for distribution and $490,000 for transmission, including the construction of nine miles of 10-in. transmission line.



Roanoke (Va.) Gas Co. plans expenditure of $75,000 to extend its system during the current year.

Rochester (N. Y.) Gas & Electric Corp. has in progress a $16,644,000 long range program of expansion which began in 1946 and will be completed in 1955. The current year's budget provides $1,273,000 for production, including a catalytic reforming plant, air blower, and gas conditioning equipment; $179,200 for transmission; and $2,116,800 for regulator stations, additional mains, services, and meters. Six miles of transmission line and 30 miles of distribution mains will be laid. An increase of 8MMcf of mixed gas will be available for daily sendout.

San Diego (Calif.) Gas & Electric Co. plans a $3,528,000 expansion this year and will spend $52,000 for miscellaneous production, $500,000 for a transmission compressor station, $1,939,000 for new customer service and improvement of existing service, and $1,037,000 for distribution, including 10 MMcf of high-pressure storage and 125 miles of distribution mains. The improvements will increase the system's ability to handle peak loads. Steel for the 10-MMcf holder has been allocated for the fourth quarter of 1952 but the project may extend into the first quarter of 1953.

Seattle Gas Co. has a $290,000 construction budget, including production, $83,000; distribution, $203,000; and general office, $4000. Although some delay in acquiring building materials may occur, the company believes they will be available.

South Atlantic Gas Co., Savannah, has a budget of $374,788, including $54,180 for plant, $247,313 for distribution, $64,245 for liquefied petroleum gas, and $9050 for general office expenditures. Savannah, Ga. and Orlando, Winter Park, and St. Augustine, Fla. will benefit.

Southern Indiana Gas & Electric Co., Evansville, has set aside $595,000 for extension of its system during 1952. The company plans to allot $159,000 for regular new business extensions, $326,500 for miscellaneous additions and improvements, $68,360 for meters and installations, and $41,140 for general plant and miscellaneous expenditures. An estimated ten miles of distribution mains will be constructed. Sufficient building materials will be available according to present indications.

Southern Union Gas Co., Dallas, has a construction budget of $11,097,286 to include the following expenditures: Drilling and lease acquisition, $3,148,000; other production, $851,612; transmission, $3,692,536; distribution, $3,074,123; and miscellaneous, $331,015. A total of 180 miles of distribution mains and 174 miles of transmission line will be laid. New facilities will enable the company to increase its output of natural gas by 50 MMcf per day for firm service and 55 MMcf for peak days. Service to its present area will be expanded and Gallup, N. M., will be added to the territory served.

Southwestern Public Service Co., Amarillo, has a construction budget of $305,540, the majority of which will be spent to expand distribution systems in towns presently served. Approximately 20 miles of additional distribution lines will be laid.

Southwestern Virginia Gas Co., Martinsville, will devote $230,000 to new construction this year. Of this sum, $215,000 has been allocated for transmission and $15,000 for distribution. The company will lay 14.8 miles of additional transmission line and 2 miles of distribution mains. New facilities will increase natural gas sendout by 400 Mcf per day.

Gas Supply Problems

Union Light, Heat & Power Co., Cincinnati, began a construction program in 1951 which is scheduled for completion by 1954 at a total cost of $2 million. Of this year's $980,000, $560,000 will be spent for transmission, $30,000 for miscellaneous, and $390,000 for distribution, including 11 miles of mains. New facilities will benefit present customers and extend service to fringes of the area served. Material shortages and gas supply problems may result in delay or curtailment of the program.

United Fuel Gas Co., Charleston, has a 1952 budget of $21,118,300. Budget items are new wells and well lines, $8,612,800; two storage pools and added facilities in present pools, $6,711,000; reinforcement of present distribution system, $1,377,200; new lines and additional facilities in present transmission system, $3,691,600; and general and miscellaneous expenditures, $725,700. Fifty-four miles of distribution mains and 127.9 miles of transmission line will be constructed. The project will make an additional 54 MMcf of natural gas available for daily service by the end of this year and 155 MMcf for peak days by Feb. 1, 1953. Sufficient pipe is on order for projects but only 65% of required oil country tubular goods will be available. No difficulty is anticipated in obtaining other controlled materials or class "B" material.

Washington: $9 Million

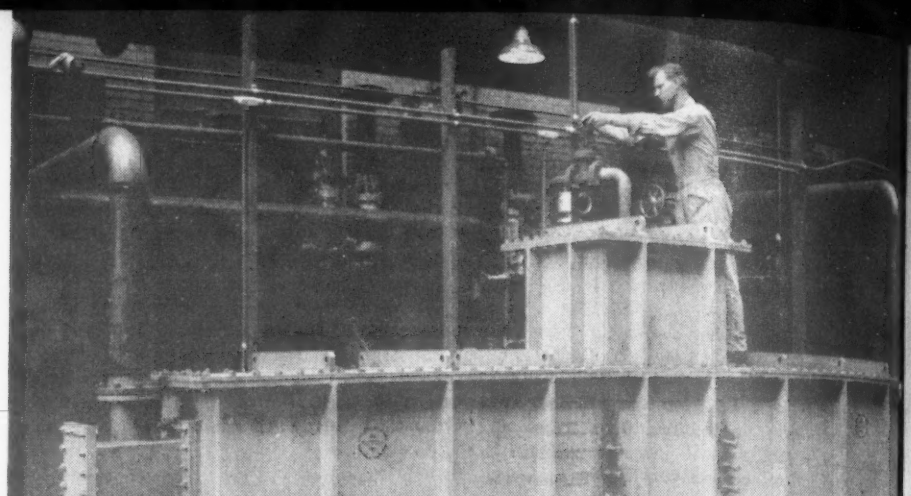
Washington (D. C.) Gas Light Co. has allocated $10,225,000 for a construction program, including $3,809,000 for production, $4,986,000 for distribution, and $1,430,000 for general plant expenditures. About 149 miles of distribution mains will be laid. The largest single project included in the building program is the 100-MMcf natural gas and L.P. gas storage plant begun in 1951 and scheduled for completion this year. The distribution budget is for the extension of gas facilities to new customers and reinforcement of the existing system to accompany development in the area now served. The company foresees some difficulty in obtaining construction materials during the latter half of the year.

Wisconsin Power & Light Co., Madison, will apply its entire $1.2 million construction budget to distribution. The company will lay 28 miles of additional interurban line and 10 miles of distribution mains. The new facilities will benefit communities already served by the company.

Wisconsin Public Service Corp., Milwaukee, will apply $1,160,000 during the current year to a construction program begun in 1950. The allocation for distribution is $1.1 million; transmission, $30,000; and production, $30,000. Two miles of additional transmission line and 16 miles of distribution mains are to be laid. Communities presently served will benefit.

Wisconsin Southern Gas Co., Burlington, will apply $187,500 to its $1 million 1950-52 expansion program during the current year. Blanket work orders and short main extensions will account for most of the expenditure. New districts to be served by the company are the Bohners Lake area and Birches and Genevista subdivisions.

An additional four firms, not listed above, will spend $4,380,800 for construction purposes in 1952. Of this total, $2,395,400 will be used for distribution, $338,000 for transmission, $1,216,400 for production, and $431,000 for other expenditures. They will add 7.8 miles of transmission mileage, 45.4 miles of distribution mains, and will increase capacity for gas output by 46 MMcf per day. This construction will be dependent upon availability of materials.



Closeup of the compact furnace which produces more than a million cubic feet of gas per day.

Reforming Natural Gas at the Rochester Plant

By GILBERT V. McGURL
Koppers Co. Inc.
Pittsburgh

Last fall, announcement was made of the installation of a low-cost, multi-purpose gas plant at Rochester (GAS, November 1951). Performance of the unit is now measurable on the basis of tests which have been made, and in this article Mr. McGurl details the results of these tests.

ADVANTAGES of the Koppers-Hasche process were outlined at the AGA Production and Chemical Conference last May by Dr. R. L. Hasche, who developed the process and the apparatus. Koppers Co. has been licensed to use the patents issued in connection with the process, and this discussion is concerned with information obtained by actual operation of an experimental plant built for Rochester Gas & Electric Corp.

The Kopper-Hasche unit is a self-contained gas plant consisting essentially of two highly efficient regenerators on either end of the unit with a space in between which can be empty or filled with catalyst. Reversing equipment is provided for reversing the flow of materials on the cycle best suited for the particular operation.

A very important feature of the apparatus is the nature of the regenerators. These units are made by stacking special refractory tile.

The demonstration plant at Rochester was designed to produce about 1 MMcf per day of city gas (540-Btu equivalent) using natural gas, gasoline, liquefied petroleum gases, etc., as raw material.

The principal items of equipment are the furnace; reversing equipment, instrument board, thermocouples, and meters; washer-cooler; and vaporizers.

1. *Furnace.* The heart of the furnace consists of two regenerator sections, each 9 in. wide, 20 in. high. At the middle of the furnace, between the two regenerators, is the reaction zone. This space may be filled with catalyst, or may be left empty, depending on the requirements of the reactions involved in the process operation. Surrounding this core is 4½ in. of high-duty refractory brick, and a like thickness of insulating brick.

The brickwork is encased in a steel shell, ½ in. thick. Outside dimensions of the shell are approximately 2 ft 6 in. wide, 3 ft 6 in. high, and 17 ft long. There is a small higher section at the center of the furnace to accommodate a heating-up burner. In operation, the path of gases is reversed end for end of the furnace at selected intervals. Incoming reactants are preheated in passing through one of the regenerators, in which heat has been stored by exit gases on the preceding portion of the cycle.

2. *Reversing equipment.* Automatic equipment provides for reversing the direction of flow of materials at selected intervals depending on the type of operation. Meters are provided for determining flow rates, as well as temperature- and pressure-recording instruments.

3. *Washer-cooler.* A washer-cooler is provided for final cooling of gases leaving the generator.

4. *Vaporizers.* They are provided for use when liquid fuels are gasified, as it is desirable to feed these materials to the unit in the form of vapors.

Operating Results

Most of the experimentation to date at Rochester has been on the reforming of natural gas which is then enriched generally with natural gas to form a mixed gas of about 540 Btu per cubic foot, so that the gas produced in the demonstration unit can be utilized by Rochester Gas & Electric.

Three modes of operation which have been used in the reforming of natural gas are continuous, heat-make, and semi heat-make.

1. *Continuous.* In the continuous type of operation for the reforming of natural gas, natural gas, air in desired ratio, and steam are mixed in a chamber outside the furnace and the mixture is fed to one

end of the unit. In passing through the first regenerator, these reactants are preheated by heat previously stored in the refractory and reaction undoubtedly starts.

When the gases reach the reaction zone, in which a commercial catalyst was generally employed, the reforming reactions are completed. The hot gases now pass through the second regenerator and give up heat which is used on the succeeding portion of the cycle. Cycles of one or two minutes have been used in most cases although other periods have been employed. The principal reactions involved in this type of reforming are shown in Formula No. 1 at the bottom of the page.

The first reaction is exothermic and evolves heat as shown, 15,370 Btu per pound mole. Theoretically, this heat can then be utilized to supply the endothermic heat required for the reaction between methane and steam, which is 88,785 Btu per pound mole. Thus, if there were no heat losses of any type, the partial combustion of 1 cu ft of methane would supply sufficient heat for the reaction of 0.17 cu ft of methane with steam.

The type of gas produced by continuous operation can be explained by assuming that the first reaction is:

$$CH_4 + 2\ O_2 + 8\ N_2 = (CO_2) + (2\ H_2O) + 8\ N_2$$

followed by—

$$2\ CH_4 + (2\ H_2O) = 2\ CO + 6\ H_2$$

$$CH_4 + (CO_2) = 2\ CO + 2\ H_2$$

$$4\ CH_4 + 2\ O_2 + 8\ N_2 = 4\ CO + 8\ H_2 + 8\ N_2$$

Net—

$$CH_4 + (\tfrac{1}{2}\ O_2 + 2\ N_2) = CO + 2\ H_2 + 2\ N_2$$

It is coincidental that the net total resembles the product of partial combustion of methane with air.

It can be seen from the reaction for the partial combustion of methane that 2½ volumes of air (½ volume of oxygen) are required per volume of methane. In most of our tests the ratio of air-to-natural gas has been maintained in the range of 1.25 to 1.30, since at this ratio, temperatures were more readily controlled and a reformed gas of about 350 Btu resulted.

The results of a typical run are shown in *Table 1.*

The gas was at all times free of carbon or tar. The nitric oxide content of the reformed natural gas was low, about 0.03 ppm, which is less than 1 gram per MMcf of gas.

In this type of operation, all the gases made go into the plant mix. The inert content of gas made in this manner is high since all of the nitrogen of the air used is in the make gas.

2. *Heat-make.* In the heat-make scheme of operation, heat is stored in the furnace on the "heat" portion of the cycle, during which time some natural gas is burned with approximately the theoretical volume of air. Products of combustion are vented to the atmosphere through a stack, although all or any portion of this gas could be used for dilution if desired. The principal reactions involved in this type of reforming are shown in Formula No. 2 at the bottom of the next page.

During the succeeding make portion of the cycle, natural gas and steam are fed to the furnace either from the same end or from the opposite end from which the heating gases were supplied. In the second half of the cycle, the direction of both heat and make gases is the reverse of that employed in the first half of the cycle. The entire cycle has generally been two minutes and the percentage of time on "heat" has been varied widely from 20% to 40% of the total cycle.

Results of a typical run are given in *Table 2.* Note that rates have not been

TABLE 1. Results of Continuous Run

Natural gas used	328,300 cu ft/d
Air used—ratio air-to-gas	1.3
Steam—pound per hour	310
Reformed gas made	919,200 cu ft/d
Natural gas per Mcf reformed gas	357 cu ft
Ratio volume reformed gas/volume natural gas	2.8
Enriched reformed natural gas at 540 Btu and 0.6 sp gr	1,295,000 cu ft/d
Natural gas per Mcf enriched reformed gas	543 cu ft

Analysis of reformed natural gas:

	As Made	Enriched to 540 Btu, 0.6 Sp Gr
CO_2 %	2.1	1.8
Ill	0.1	0.1
O_2	0.8	0.6
CO	13.2	9.4
H_2	29.3	20.8
CH_4	19.7	40.1
C_2H_6	0.0	1.9
N_2	34.8	25.3
Btu	340	540
Sp gr	0.63	0.62

Temperatures:

Catalyst	1755-1980° F
Exit from furnace	350- 450° F

Formula No. 1

$$CH_4 + \tfrac{1}{2}\ O_2 + 2\ N_2 = CO + 2\ H_2 + 2\ N_2 + 15370\ Btu$$

$$CH_4 + H_2O = CO + 3\ H_2 - 88785\ Btu$$

TABLE 2. Results of Heat-make Run

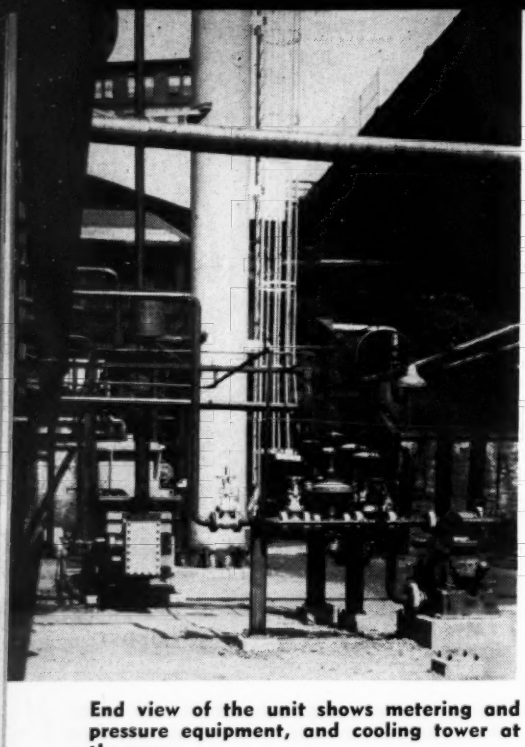
Natural gas used—Heat	21,290 cu ft/d
Make	75,480 cu ft/d
Total	96,770 cu ft/d
Air used—ratio air-to-gas—on heat only	10
Steam, lb per hr on make only	600
Reformed gas made	214,800
Natural gas per Mcf reformed	450 cu ft
Ratio volume reformed gas/total volume natural gas	2.22
Enriched reformed natural gas at 540 Btu and low sp gr	282,300 cu ft/d
Natural gas per Mcf	557 cu ft
Enriched reformed natural gas at 540 Btu and 0.6 sp gr	491,600 cu ft/d
Natural gas per Mcf	581 cu ft

Analysis of reformed natural gas:

	As Made	Enriched to 540 Btu, Low Sp Gr	Enriched to 540 Btu, 0.6 Sp Gr
CO_2	3.4	2.9	4.1
Ill	0.6	0.4	0.3
O_2	0.2	0.2	0.1
CO	18.2	13.9	8.0
H_2	60.9	46.2	26.6
CH_4	11.0	29.9	37.2
C_2H_6	0.0	1.6	2.3
N_2	5.7	4.9	21.4
Btu	386	540	540
Sp gr	.401	.45	0.6

Temperatures:

Catalyst	1435-1900° F
Exit from furnace	350- 470° F



End view of the unit shows metering and pressure equipment, and cooling tower at the rear.

too high and at this writing the endeavor has not yet been directed toward high capacity when using this type of operation.

Enriching to 540 Btu and increasing specific gravity to 0.6 permits the use of blow run gas and increases the total make considerably.

3. *Partial heat-make.* This manner of operation is a combination of the two modes just described. For a portion of the cycle, natural gas is burned with approximately theoretical air to store heat in the unit. The following make portion of the cycle is made by adding natural gas, steam, and some air to the gasifier. It has an advantage over continuous operation in that the hydrogen content of the reformed natural gas is higher and the hydrogen-to-inert ratio is over one. The results of this manner of operation are shown for a typical run in *Table 3.*

Other Raw Materials*

Operation of the Koppers-Hasche furnace at Rochester using vaporized liquid petroleum products is now underway. Sufficient information is not available to report complete details of this operation at this time.

However, in a similar unit, Dr. Hasche has gasified these materials successfully. In his AGA paper previously mentioned, he gives analysis of gases resulting from the reforming of propane. These analyses are shown in *Table 4.*

With casinghead gasoline, the analysis of a high-Btu gas would be about as shown in *Table 5.*

*Gasoline, kerosene, L.P. gases, gas oil, etc., are being tested in the Rochester furnace. Complete data have not been compiled.

About 96 cu ft of this gas were made per gallon of gasoline or 118,000 Btu per gallon as gas. Actually this gas was used as a source of ethylene for chemical manufacture. In gas plant operation further cracking or dilution would probably be desirable.

Summary

In conclusion, it appears that the Koppers-Hasche process can be used by the gas industry for:

1. Reforming of natural gas for companies distributing mixed gas.
2. Reforming of liquefied petroleum gases.
3. Manufacture of high-Btu gas from liquid fuels as supplementary fuel for use in admixture with natural gas.

The desirable features of the gasifier are many, including:

1. Compactness—little ground space is required.
2. Outdoor installation.
3. Low maintenance due to the fact that there are very few moving parts.
4. Little supervision required because of automatic operation.
5. High efficiency of gasification.
6. Low capital cost.
7. Use of any hydrocarbon which can be vaporized and vapors fed to the unit.
8. Rapid operation from a cold start.

TABLE 3. Results of Partial Heat-make Run

Natural gas used—Heat	18,600 cu ft/d
Make	345,700 cu ft/d
Total	364,300 cu ft/d
Air used—ratio air-to-gas—heat	10
Air used—ratio air-to-gas—make	0.8
Steam, lb per hr on make only	450
Reformed gas made	816,000
Natural gas per Mcf	450 cu ft
Ratio volume reformed gas/total volume natural gas	2.24
Ratio volume reformed gas/make volume natural gas	2.36
Enriched reformed natural gas at 540 Btu and 0.6 sp gr	1,017,000
Natural gas per Mcf	559 cu ft

Analysis of reformed natural gas:

	As Made	Enriched to 540 Btu, 0.6 Sp Gr
CO_2	2.2	2.0
III	0.6	0.5
O_2	0.2	0.2
CO	12.9	10.3
H_2	35.2	28.2
CH_4	24.2	37.2
C_2H_6	—	1.3
N_2	24.7	20.3
Btu	419	540
Sp gr	.571	.58

Temperatures:

Catalyst	1410-1800° F
Exit from furnace	350- 465° F

TABLE 4. Analysis of Gases from Reformed Propane

CO_2	1.4	1.6	1.6	1.6
C_2H_2	0.6	0.4	0.3	0.2
C_2H_4	13.9	14.1	14.0	11.7
C_3H_6	3.6	5.9	7.2	7.5
O_2	1.7	1.2	1.2	1.2
H_2	8.5	9.0	8.4	7.4
CO	6.9	5.0	3.8	2.6
CH_4	13.8	14.6	14.7	12.4
C_3H_6	4.7	8.4	14.1	20.2
N_2	43.9	39.8	34.7	35.2
Btu	637	753	946	1028
Sp Gr	0.9	0.92	0.96	1.01
Rates—feed air to propane	2.1:1	1.6:1	1.16:1	1.09:1

TABLE 5. Analysis of Gas from Casinghead Gasoline

CO_2	0.3%
O_2	0.4
H_2	18.7
CO	0.9
CH_4	29.8
C_2H_2	3.9
C_2H_4	37.5
C_3, C_4	8.5
Btu	1228

Formula No. 2

$$CH_4 + 2\ O_2 + 8\ N_2 = CO_2 + 2\ H_2O + 8\ N_2 + 382{,}000\ \text{Btu}$$

By C. GEORGE SEGELER
American Gas Assn.
New York

Put the New Gas Installation Standard To Work

SINCE all of us, as taxpayers as well as utility men, are audibly groaning about the present extent of restrictive legislation — actual, pending and proposed—it may seem odd that we should be urging more of the same. Yet, we should do that very thing for two purposes, each of which should prove of great benefit to the gas industry and to its customers, the taxpayers.

The new gas installation standard is new in the sense that it is complete, up-to-date and pre-eminently practical. We have had standards before, but they lacked these features and as a consequence were adopted to a rather limited extent. The new standard, on the other hand, has these advantages and consequently its adoption into local and state ordinance has been surprisingly rapid in many localities.[1]

Out of Date

The larger cities in the New England states have building codes which include, to a greater or lesser extent, some clauses referring to gas. These clauses are not uniform and they are not up-to-date, as far as AGA records show. But, there are in the New England states 76 utility gas companies who reach into 379 communities and in addition there are many areas in which L.P. gas service is also involved. This large number of individual communities is the basic argument for the adoption of a single nationally recognized standard rather than the adoption of individual building codes conceived exclusively with reference to local needs. Nationally, almost 30% of U. S. municipalities have no building code at all.

Building codes are essentially an exercise of the authority of a state. The actual requirements are usually local in character by virtue of delegation of the state's power to the municipality, either through charter provisions or special enabling acts, but the power itself is of state origin. This is an important point to bear in mind since there is a growing tendency for states to exercise this power. Right now such activity is under way in New York, California, Wisconsin, Arizona, and possibly elsewhere.

We can agree that our industry has not been restricted or hampered by gas codes of objectionable character. It has been argued that this absence of restrictive legislation is even beneficial. It is said that installation costs are kept down since there are no permits or fees, and because of the exercise of freedom of choice of an installation method.

Furthermore, a very significant point is raised in the argument that gas companies serving a large number of communities are not troubled in the administration of their service departments by local requirements which might be inconsistent or even conflicting in character. The effect of conflicting codes upon the efforts of sales and service departments speaks for itself.

All of this could very well be true if it weren't for two stubborn facts that keep interfering with such a comforting, though possibly specious line of reasoning. The first of these facts is the matter of public safety. I suspect that all of us have been disturbed by the attention which this is receiving in the public press and the radio and, in many cases, from the authorities. The second fact is that there already are so many numerous indirect controls over the manner of installing gas and its equipments. With these two points in mind it would seem that we might as well take the bull by the horns and urge the adoption of a single acceptable and universal standard for the installation of gas piping and appliances.

To go into the matter of public safety in a little more detail, AGA asked the U. S. Public Health Service to prepare a transcript of the microfilms of certificates of death in which gas was involved. These data for the years '47, '48, and '49 were confined to Account No. 178A in the International Classification of the Causes of Death which is the category covering accidental deaths from utility gas. Our statistical department then applied population estimates to these data. This gave a fatality index which could be used to compare communities with different populations, and which might serve as some measure of the value of any steps taken to improve consumer safety. Since there is no absolute measure of what constitutes a good level of safety with respect to gas, the median figure for the New England region may be of interest. This now stands at 1.81. This is the *median* fatality index per 100,000 population. Any company can easily obtain, from its health departments, local records of Account No. 178A and make its own comparisons.

Correlation?

Is there a correlation between this index for an individual community and the building code? If there is (that is to say, if administration of an effective code would result in a lower fatality index), then it would become a cogent reason for the taking of similar steps in communities with high indexes. Undoubtedly such a relation exists but it is not possible to prove it by the limited statistical data available.

Today many of you are thinking primarily about natural gas, which being non-toxic should automatically have the effect of eliminating all but a very few deaths from leaking or unburned gas.

Primarily, then, the natural gas fatality index is an index of incomplete combustion; that is, it is largely an index of

[1]Just to name a few—most of the larger cities in Wisconsin, including Milwaukee; scattered cities throughout the South; New York state plus 15 communities in New York state; Philadelphia, etc.

Presented at the New England Gas Assn. business conference in Boston, March 28.

the venting practices.[2] The median fatality index for small natural gas companies for the same three-year period was .0; for the intermediate size companies it stood at .4; and for the larger companies it stood at .5. The contrast between these data and those for manufactured gas is so great that there has been some tendency to look upon the change to natural gas as a guarantee of consumer safety.

That this is not valid can be realized when the details of the natural gas picture are studied. There are natural gas operations with fatality rates well above the New England median so that while we may conclude that there is likely to be a big improvement from the introduction of natural gas, it may not completely solve the problem of consumer safety.

Venting of water heating, space heating, and central heating equipment will be an important factor regardless of the type of gas, and an excellent way to improve the venting situation is to make use of our industry's new standard. This is known as ASA Z21.30, American Standard Installation of Gas Piping and Gas Appliances in Buildings. It is identical, word for word, with Pamphlet 54 issued by the National Fire Protection Assn. and separately by the National Board of Fire Underwriters. These new standards differ from others which have been proposed in the past by being informative and specific. These standards show what performance must be obtained from an appliance and, in turn, how this can be accomplished in a practical manner.

The standards answer the questions of the inspecting and enforcing agency. Piping and appliances which are installed as recommended give the customer assurance that he will be safe from the risks of fire and asphyxiation. Furthermore, the recommendations regarding the use of approved appliances and listed accessories provide the additional assurance that the appliances themselves will be safe, free from leaks, durable, efficient, and easy to maintain.

How can these standards best be used? My remarks have already suggested that they might be useful for a building code or for a special gas ordinance, but all of us know that that is only part of the job. There must be an understanding of these standards and a desire to use them on the part of builders, installers, plumbers, and the enforcing agencies. Because of that, some companies have very effectively started on the road toward eventual legal adoption by securing substantial numbers of copies of these standards for the purpose of giving them to builders, building inspectors, fire chiefs, health commissioners, plumbing contractors, and appliance dealers. To a large extent these agencies desire this kind of information and are looking for assistance which will help them guide their people in putting in a good gas installation. This isn't just a matter of mailing standards to the respective recipients. It requires working with them to explain what the standards mean in a practical way.

Even if they are not yet adopted in the legal sense, full understanding of what is in them on the part of appropriate authorities can be very effective. Recent experience in Westchester county, New York, has provided a practical demonstration of the value of distributing and explaining the meaning of Z21.30 rules although nothing had been done about their actual adoption. During conversion to natural gas, conversion crews found numerous safety violations. The utility company was in a dilemma as to what to do. Here is where prior distribution of the standard did its work. Health and fire departments took advantage of general policing powers, granted them in the interest of public safety, to declare these faulty gas jobs violations. Building owners were forced to take the necessary corrective steps.

The Local Situation

Granted that an ordinance is desirable, how shall adoption be secured and shall the standard be modified for local conditions? The latter question is easier to discuss, and therefore let's take it first. The reason for adopting the standard to fit local conditions always seems valid, desirable, and necessary to local lawmakers. There seem to be some obvious advantages. Unfortunately, the obvious disadvantages are not always scrutinized as carefully. They are an ultimate increase in the cost to the builder and home buyer.

The reason that local ordinance variations make for higher costs scarcely needs to be explored. The more local variations are adopted, the more local codes differ from one another, causing this problem to become worse with time. You have all seen it discussed at length in the public press under the general heading "Chaos in Building Codes." Several national agencies are at work in an effort to unify building codes and to substitute a performance type of code for construction type. The advantage in leaving the code alone lies in uniformity, making it possible for everyone to gain the basic benefits, and making it possible for the manufacturers to produce equipment which will meet the requirements in all parts of the country to the ultimate gain of home owners.

Sometimes you will find local modification necessary, but the step should be taken with the greatest reluctance. I would like to present two illustrations of this point. The first is the case of a prefabricated house with considerable steel construction. In this type of house, conventional flexibility in the location of gas and electric meters and services was not practical. You just can't cut holes anywhere. Therefore, the fabricator wanted to standardize on meter locations. Was this possible? Indeed not. Some utilities wanted the meters outside the house, some inside, some required them to be 5 ft, others 4 ft, off the ground. Required separation between meters varied from a few inches to several feet. Some wanted the meters in boxes, some not. Some boxes had to be ventilated, others closed. We scarcely need to argue that somewhere in this welter of requirements there is a reasonable concept of how meters should be set.

The second local variation is much more complicated. This is the question of whether or not merchandisers of gas appliances should be licensed before they may sell them. In some cases, official sentiment is that installers rather than merchandisers be licensed, and then only after tests of competency. In other communities licensing is likely to lead to unnecessary delay in the availability of efficient gas service. Without taking any side as to which is best, we can perhaps agree that any gas utility should certainly pay particular attention to the matter of competency of service and installation men, and should endeavor to formulate effective, equitable, and practical means of controlling the quality of workmanship and service within its jurisdiction.

That brings us to the first question: How shall adoption of a nationally recognized uniform code be secured? At first glance this seems quite simple: just

[2] I said primarily because there are some gas accidents resulting from gas leaking into buildings, which are put into a different category in Health Department statistics. They are, therefore, not included in the U. S. Public Health figures in Account No. 178A.

have the local lawmaking body adopt it. That is where the trouble starts. According to my latest information, there are only 15 states which permit local communities to take such a simple and obvious step. Of this group of states, New Hampshire is the only one in the New England six. Lucky communities!

In New Hampshire, 21 gas-using communities need only adopt a local ordinance or modify a local building code to say that they wish to adopt the American Standard Z21.30 (and its subsidiary Z21.8) giving the identification and the date of adoption of this standard. This is an inexpensive matter for the community and since the standards themselves are available at nominal cost from us or the National Fire Protection Assn., and are even distributed free of charge by the National Board of Fire Underwriters, no one would have any trouble in getting himself a copy and knowing exactly what to do about gas.

There is only one fly in the ointment: What happens if these agencies revise the standard and wish a new one? If that does happen, and you can surely anticipate it, then someone must be alert in the locality to ask the town council to pass an amendment adopting the new standard. This entire procedure is known as the "Adoption By Reference" method.

This question of date is a real problem in many cases, and there are some startling examples of out-dated ordinances using adoption by reference. The most famous case is a city which adopted the National Electric Code in 1897 and made no change since. Sometimes another pitfall traps the unwary, and there is an example before me right now in the form of a senate bill in Arizona. I refer to the improper type of wording which adopts a specific standard by reference and then adds the words "or latest revision thereof." When we look at this idea it seems good, but it is, in effect, handing over the right to make a local law to some outside agency — in this case, let us say, the American Gas Assn. The community knows exactly what it adopted when a specified standard was enacted into the ordinance. This community must not give away its lawmaking rights to someone else by adding "or latest revision."

Throughout the other New England states, towns wishing an ordinance would have to spell out exactly what is wanted. Instead of adoption by reference, all the desired clauses from various sources are assembled under one cover and are then printed in full as the local code or ordinance. There is no objection to this, particularly in a large city which can well afford to print such books. For the smaller places there is great temptation to drop items from the national standard and to make such local modifications as occur to the happy legislatures at the time. This is perhaps why any effort to compare and correlate the codes of New England is so hard.

Connecticut wrestled with this problem a bit and did pass a special act to adopt by reference a gas venting standard proposed by the state. This is, however, very limited in scope and may eventually complicate the adoption of a nationally recognized standard.

Another argument for adopting a nationally recognized standard is that federal agencies in many situations already require builders to meet AGA standards. This is an indirect way in which standards come into use in a community. For example, the Minimum Property Requirements of the Federal Housing Administration and the Veterans Administration require use of AGA-approved appliances. This is something that city ordinances have so far required only in a handful of communities, although gas companies have subscribed to the idea for so many years. Other indirect controls are probably well known to you. They stem from activities of insurance rating bureaus, engineering laboratories like Underwriters' Laboratories or, in the case of industrial plants, from the Factory Mutuals or the Factory Insurance Assn.

What Should Be In It?

If you are convinced that an ordinance is desirable, what should be in it? The provisions of a satisfactory ordinance should outline the installation of gas appliances so as to permit their safe and efficient use. They should limit the selection of appliances to those which meet the American Standard Approval Requirements as evidenced by the AGA Seal of Approval. The ordinance should prohibit the sale, installation, and use of gas appliances which cannot meet such minimum standards and the ordinance should be so devised that it can be brought up to date from time to time. These are the four basic points which a gas installation ordinance should cover.

It would be natural for you to ask, "Is there anything which can be done to meet these worthy needs in the face of all difficulties?" We think there is. The American Gas Assn. is taking active part in a project of the American Standards Assn. known as Z56—Model Laws and Ordinances. Out of that program comes a suggestion which has already been widely and effectively utilized in securing the adoption of modern gas codes. It is intended to overcome two problems. The first is what to do in states where adoption by reference is not yet possible, and the other is how to keep a code up to date. We are calling this procedure the "prima-facie evidence" method. It has already been used many times during the last two years with complete success.

From a typical ordinance of this kind, such as that of Sheboygan, Wis., I quote the two key phrases which comprise the ordinance:

"1. *Safety standards;* all gas appliances and accessories herewith installed, sold, or offered for sale shall conform to reasonable standards of safety, and

"2. *Installation standards;* gas appliances, accessories, and piping systems shall be installed to conform to reasonable standards of safety."

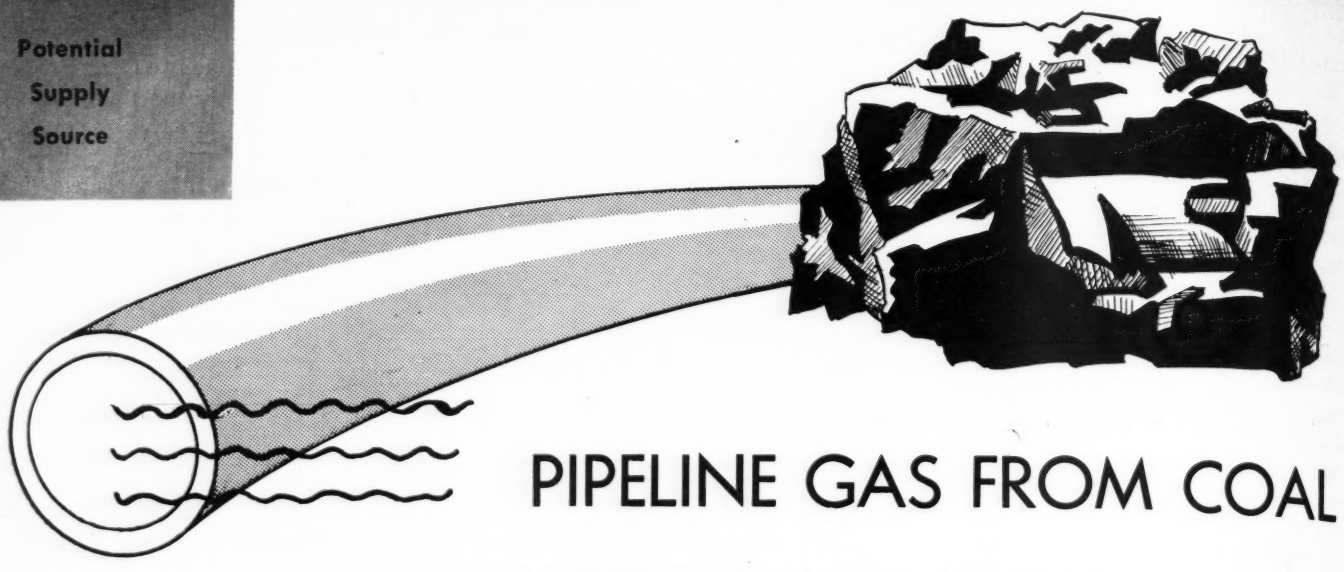
You will recognize these two statements as common concepts of safety. To put teeth into them and thereby to secure enforcement of Z21.30, the ordinance has additional clauses or footnotes. These are ostensibly for the guidance of enforcement officers. They read quite simply: "The presence of the seal of a nationally recognized testing agency, adequately equipped and competent to perform such service, shall be *prima-facie evidence* that the appliance in question conforms to such reasonable concepts of safety.

"Such a testing agency shall be one which maintains a program of national inspection of production models of all approved types of gas appliances at least once each year on the manufacturer's premises. Approval by the AGA Testing Laboratories as evidenced by the attachment of their Seal of Approval or a certificate or letter certifying approval shall be considered as such *prima-facie evidence.*"

In a similar vein, conformity to Z21.30, etc., shall be considered *prima-facie evidence* of reasonable safety in line with the second clause of the ordinance.

While this type of ordinance is perhaps not the final answer, since the enforcing authority might possibly accept some other kind of evidence, it is believed that it goes a long way toward accomplishing what hasn't yet been done in 25 years of approving appliances.

Potential Supply Source



PIPELINE GAS FROM COAL

● *The question of possible future deficiency of natural gas for use in the Northeast has stimulated intensive research into the economics of manufacturing gas for pipeline transmission*

By C. R. BRECK
Southern Natural Gas Co.

IN the running discussion, over the past several years, as to the life and adequacy of our natural gas reserves, there has been some accord among experts on the belief that eventually it will be necessary to augment deliveries of natural gas in the northern markets by development of a more-or-less comparable synthetic gas made from coal.

It may be later than many people think: The demand for industrial and commercial pipeline gas in at least the extreme Northeast section of the United States will probably be felt rather keenly before an adequate economic synthetic pipeline gas project could be completed, even if initiated soon.

The evidence is considerable that such a project would be technically sound and economically self-supporting, although the margin of profit at first might be so small and the magnitude of the economic enterprise so great that government financing aid would be needed.

To simplify an examination of the situation, let us consider the potential marketing areas within range to the north and east of three pipelines: Tennessee Gas, as it enters Erie county, N.Y.; Texas Eastern, just before the tap supplying the Philadelphia area; and Transcontinental, as it enters New Jersey.

The three lines draw gas from Texas and Louisiana. Ultimate maximum combined deliverability at the three points is about 1.2 billion cu ft per day, at maximum load factor probably attainable in normal operation. Eventual or present markets north and east of the three points are central New York state, from Buffalo to Albany, inclusive; New York City, Westchester, Nassau, and Suffolk counties, N.Y.; Connecticut, Massachusetts, Rhode Island, and New Jersey; Philadelphia, together with Delaware, Chester, Montgomery, and Bucks counties; and populated districts bordering gas lines in these areas.

Let us use the sales records of Michigan Consolidated, Detroit, and Equitable Gas, Pittsburgh, as guides to measure probable demand in these areas. For the four quarters ended Sept. 30, 1951, annual sales of domestic and commercial gas for the two companies were thermally equivalent to 114 billion ft of natural gas. Average consumption for the 943,000 domestic and commercial customers in the two areas was equivalent to 330 cu ft of natural gas.

In the Northeast area under consideration, the estimated (1950) 8 million such customers, using 330 ft average, would demand a total of 2.6 billion cu ft which, on the basis of stated maximum pipeline capacity, would indicate a deficiency of 1.4 billion per day. Considerable shortages in gas supply in both Detroit and Pittsburgh areas would indicate that this estimated deficiency is on the low side.

If the supplying pipelines are operated at 80% load factor, about 65% of the deficiency, or more than 900 MMcf, can be supplied by pipeline gas—if it's available. To what extent will it be?

At the end of 1951, proved reserves were 193.8 trillion cu ft, against marketed annual production of 7 trillion.

If we use the FPC's multiplier of annual load requirements, 20, to establish the amount of reserves needed to support a new long-distance line, proved reserves of 140 trillion are desirable to support present total marketed production. Subtraction from total reserves leaves 53.8 trillion ft to support total added marketed production, with no assurance that the ratio of proved reserves to marketed production will ever get any better. This 53.8 trillion will support a market increase of only 35%, whereas the deficiency in the Northeast has been shown to be equivalent of 75%—not of 1951 marketed production, but of marketed production sometime in the future when all three lines are marketing their maximum capacity.

Demand everywhere throughout the United States, meanwhile, is growing every year.

While mammoth new fields may be discovered or FPC may approve more lines for the Northeast, in view of today's situation, it would seem unlikely that the deficiency can ever be wholly supplied by natural gas.

Anticipating the situation that is developing and realizing that five years might be required after the go-ahead signal before the bugs could be eliminated from an economic-size synthetic pipeline gas plant to make it commercially feasi-

Adapted from a paper presented at a recent AIME meeting.

ble, our company in 1944 began investigating the technical and economic practicability of making pipeline gas from coal.

We selected the German Lurgi process for tests of the first step, the making of a synthesis gas from bituminous, and used a nickel catalyst for converting this to methane. The Bureau of Mines cooperated, doing the work in its Pittsburgh laboratory. The results confirmed in our minds the technical practicability and methanization techniques proposed and provided figures for estimating cost of the gasification step.

To get a realistic cost estimate, we assumed the enterprise to be developed on the Monongahela river in Pennsylvania, Pittsburgh seam bituminous for the raw material, a daily output of 250 MMcf of pipeline gas at 1200 psi.

Blaw-Knox estimated costs from the process char stockpile onward.

Principal steps contemplated in the overall process are shown in the accompanying box.

Both sulfur and tar would be recovered as by-products of the process. The estimates assume that the sale of sulfur and tar would make the sulfur recovery and low-temperature carbonization operations, including capital charges, self-supporting.

Assuming the cost of coal to be $3.70 a ton stockpiled at the plant, the cost of the above steps according to the Blaw-Knox estimates would be as shown in box.

Of this total, "capital charges," including a 6% return on the overall investment, add up to 23.83 cents and "process raw materials" to 24.23 cents.

Overall cost, starting from the process char pile, would represent an investment of $156 million. Coal reserves for 50 years, mine development, coal transport facilities, etc., represent $63 million. Thus, total money required is estimated to be $219 million, exclusive of sulfur recovery and low-temperature carbonization plant.

Based on the estimates, almost exactly one-half of the makeup of the overall cost of pipeline gas consists of process raw materials and maintenance supplies — costs which vary in direct proportion with load factor. From a load factor point of view, this is considerably more favorable than the ratio between costs dependent on use and costs independent of use prevailing at present in connection with the long distance natural gas pipelines that serve the north. Nevertheless, because of the relatively high cost of synthetic gas, high load factor at the synthetic gas plant is a vital consideration.

Except for extreme winter peaks, gas storage in the general Pittsburgh area and eastward, together with the output of high-Btu oil gas installations in the marketing areas contemplated, will no doubt be the means used to correct unfavorable load factor effect resulting from heavy winter heating demand and lack of interruptible industrial loads.

Also, it seems reasonable to assume that a synthetic pipeline gas plant on the Monongahela river could operate at a 90% load factor, and by storing excess gas output in the summertime enable a pipeline to the east to operate at an 80% yearly load factor or thereabouts. The cost of pipeline gas at 90% load factor (instead of 100%) would be approximately 58 cents per Mcf.

Once a permanent deficiency in normal gas supply is recognized, a price of 58 cents for gas on the Monongahela river would certainly not be prohibitive. However, several of the links in the cost chain that add up to this figure are still at an unproven stage. With the exception of coal carbonization, it is hardly conceivable that such items could increase the 58-cent total more than a very few cents and, indeed, there are other items that in a final estimate might offset any such increase.

The net cost of the low-temperature carbonization of coal is an unproven cost item of more concern. First, the net cost will always be governed largely by the selling price of by-product tar, and second, a cheap low-temperature carbonization process has not to date been developed on a commercial scale.

Nevertheless, in view of the numerous efforts presently directed toward the development of such a process, I believe there is justification for the assumption, at least in a preliminary estimate, that the low temperature carbonization can be made self-supporting.

Acknowledgment

C. Ross Holmes, consulting engineer, furnished the pipeline capacity figures.

STEPS IN THE GAS-FROM-COAL PROCESS

Step 1. A synthesis gas is made from the char product of the low-temperature carbonization of coal. The cost estimates assume the use of Lurgi gasifiers, and for the most part are based on operating data derived from our experiments.

Step 2. The gas is purified. The cost estimates assume the use of a recently developed German solvent known as Rectisol. This solvent dehydrates the gas, all forms of sulfur are removed, and carbon dioxide content is reduced to approximately 4%.

Step 3. Methanization. The cost estimates assume recirculation through the catalytic chamber a number of times, the carbon monoxide and hydrogen in the synthesis gas reacting to form methane.

Step 4. The gas is again purified by the use of Rectisol, and water and carbon dioxide resulting from secondary reactions in the catalyst chamber are removed. The cost estimates assume gas makeup after final purification to be approximately as follows. This makeup is in line with results shown by our experimental program to be obtainable, and gives a calorific value slightly in excess of 925 Btu per cu ft of gas.

Pipeline Gas Makeup

CO_2	0.8%	C_2H_6 & Ill.	3.7%
N_2	3.8%	H_2	7.5%
CH_4	84.2%	CO	0.0%

Total 100%

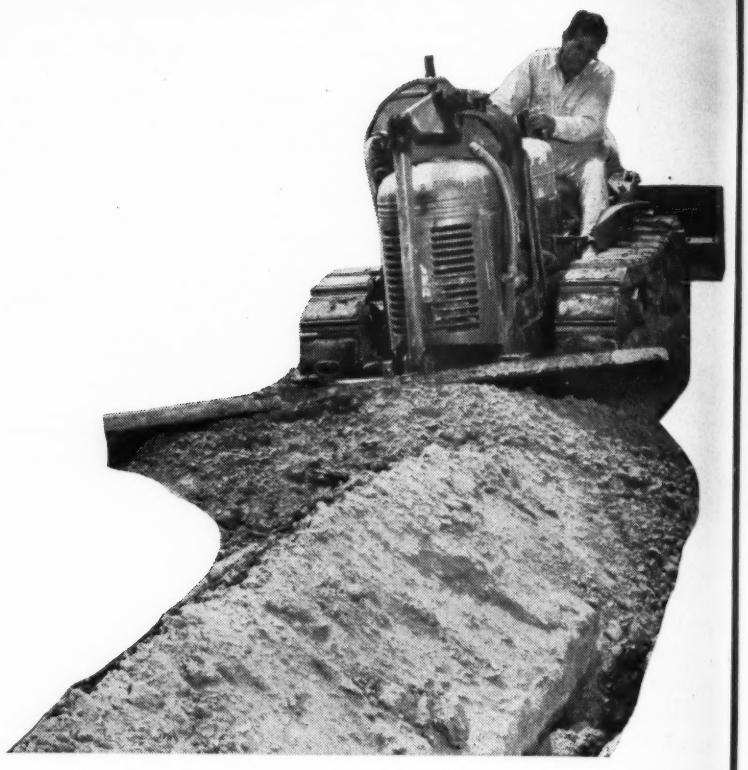
Step 5. The entire operation is carried on at a pressure of approximately 300 psi. In this last step the gas is further compressed to 1200 lb for delivery to the pipeline.

BREAKDOWN OF COSTS OF THE STEPS

	Cost in Cents per Mcf (at 100% load factor)	
Net cost of coal and char	20.44	
Plantsite facilities	5.00	25.44
Step 1. Gasification	17.91	
Step 2. Initial gas purification	6.44	
Step 3. Methanization (after giving effect to steam credits)	2.54	
Step 4. Final gas purification	1.25	
Step 5. Final gas compression	1.19	29.33
Total cost of pipeline gas		54.77

Trench Backfill

Soil Mechanics in Trench Backfilling



By FRED N. FINN

THE problem of backfilling trenches has been defined by Prof. H. E. Davis of the University of California in these words: "Broadly stated, the essence of the problem is finally to repair a pavement through which a cut has been made, in as permanent a manner as possible, consistent with reasonable minimum of public inconvenience."

It is the primary purpose of this presentation to discuss the physical characteristics and placement requirements of the replaced native material below the pavement base and above the bedding material. To be considered are the general principles of soil mechanics and their relationship to trench backfill. These principles have been well established but their relationship to trench backfilling at present can only be described as an "engineering guess." *Fig. 1* shows a typical cross section of a utility type trench with its various components.

There are two factors of importance relative to the subject of trench backfill: economy and service. As is the case in the majority of engineering problems economy is of importance and cannot be overlooked. However, the factor of service (or structural adequacy) is the primary consideration in this article.

If a trench backfill is to withstand traffic without showing signs of distress it must meet the two tests of stability and settlement.

Stability of the backfill material is the ability of the trench material to withstand loads without plastic deformation. According to the principles of soil mechanics, stability is determined principally by the shear strength the soil is capable of developing. Shear strength in turn is dependent upon cohesion and internal friction.

High Shearing Strength

Sands characteristically exhibit high shearing strengths because of their high frictional resistance. This resistance is dependent upon density, degree of saturation,[1] and surcharge load. Clays characteristically exhibit a relatively low shear strength. The principal contributor to this strength is the cohesion caused by the surface tension forces surrounding the clay particles. Cohesion is dependent principally upon water content and density; it is not affected appreciably by increasing the surcharge load.

It is of significance relative to cohesion to note that, in accordance with theory, practically all of the cohesion forces will diminish to zero when the material is saturated since no water films exist. Silt is somewhere between sand and clay relative to shear strength. Not primarily related to shearing strength but of general interest to the soils engineer is the fact that silty soils exhibit the greatest tendency toward capillary action in comparison to sands and clays.

A factor of unknown significance pertaining to stability is the confinement characteristic to a trench. Investigation should be made to determine the effects of this confinement.

Settlements, other than those caused by plastic deformation, are due to compression or compaction.

Consolidation, as described by Terzaghi, accounts for settlements in clay due to the movement of water from the saturated mass, usually caused by an increase in surcharge pressure. Settlements due to compaction are caused by the displacement of air from a soil mass. This causes higher densities but, while increasing stability, results in deformation.

The two factors, stability and settlement, which are of critical importance to any foundation, have been described. It remains now to consider their relationship to trench backfill.

This article was presented to the southern California chapter, American Public Works Assn., in August 1951. Mr. Finn is a lieutenant, CEC, U. S. Navy, and was formerly with the Institute of Transportation & Traffic Engineering, University of California.

[1]The reader will note that reference was made to degree of saturation and not water content. Actually, the frictional resistance between particles is not reduced appreciably by an increase in water content, but is reduced due to the development of pore pressures which in turn is dependent upon saturation.

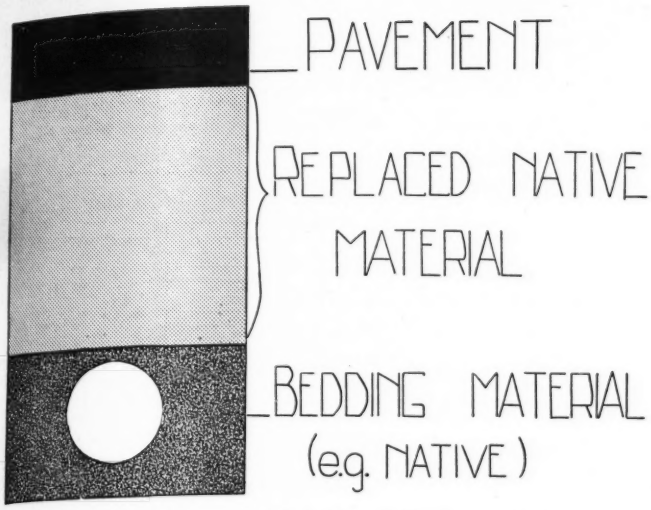


Fig. 1. Typical cross-section of a utility type trench.

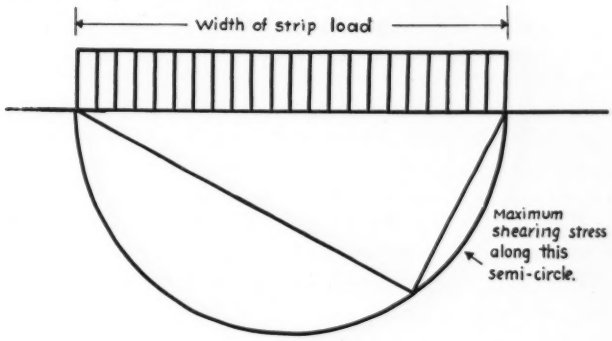


Fig. 2. Relative position of the surface of greatest shearing stress.

In order to have some idea of the shearing stress in a flexible pavement foundation, engineers have used some of the theory applicable to strip loads. Using this theory, it can be shown that the maximum shearing stress exists along the periphery of a semi-circle, the diameter of which is equal to the width of the strip load. Based on the theory of elasticity, maximum shearing stress along this surface is equal to the unit pressure divided by Pi (3.1416). *Fig. 2* shows the relative position of the surface of greatest shearing stress.

McCleod-Palmer Findings

Recent investigations made by McCleod of Canada and Palmer of the Bureau of Yards and Docks indicates that the maximum shearing stress under a circular rigid plate is located under the center of the plate at a depth approximately ⅔ to ¾ the radius of the plate. This is, in all probability, closer to the true picture for wheel loads. However, it is apparent that the material requiring the highest shearing strength is within a relatively small distance from the surface, roughly from the surface to 6 in., for present day wheel loads and tire pressures.

It is also significant that shearing stress is a function of the unit pressures. In other words, the shearing stress below a tire having 250-psi pressure would be twice the shearing stress under a tire with 125-psi tire pressure. In accordance with these facts, materials in the deeper strata of the trench need not necessarily have high stability characteristics. It is for the soils engineer to determine accurately the stability requirements consistent with the shearing stresses developed under anticipated loading. Methods of evaluating stability have been developed for building and embankment foundations. It is conceivable that similar methods could be applied to trench backfills.

The force that contributes to compression and/or compaction is the vertical pressure on the soil strata. If the vertical pressure is low, the amount of compression and/or compaction is correspondingly low.

According to theory and to actual tests, the pressure below the point of loading is approximately inversely proportional to the square of the depth. It is also a function of the unit pressure. *Figs. 3* and *4* show the effect of the so-called "pressure bulb." It can easily be seen from these charts that the unit pressures decrease very rapidly to a depth equal to the diameter of the contact pressure. Vertical pressures at a depth 1½ times the contact diameter are reduced by 75 to 90%, depending on the type of loading and character of the loaded material.

Vertical Pressures

Fig. 3 represents the vertical pressures developed at various depths by pneumatic tired rollers based on measurements made on sandy soil by the O. J. Porter Co. *Fig. 4* represents the distribution of vertical pressures developed below a rigid circular plate at various

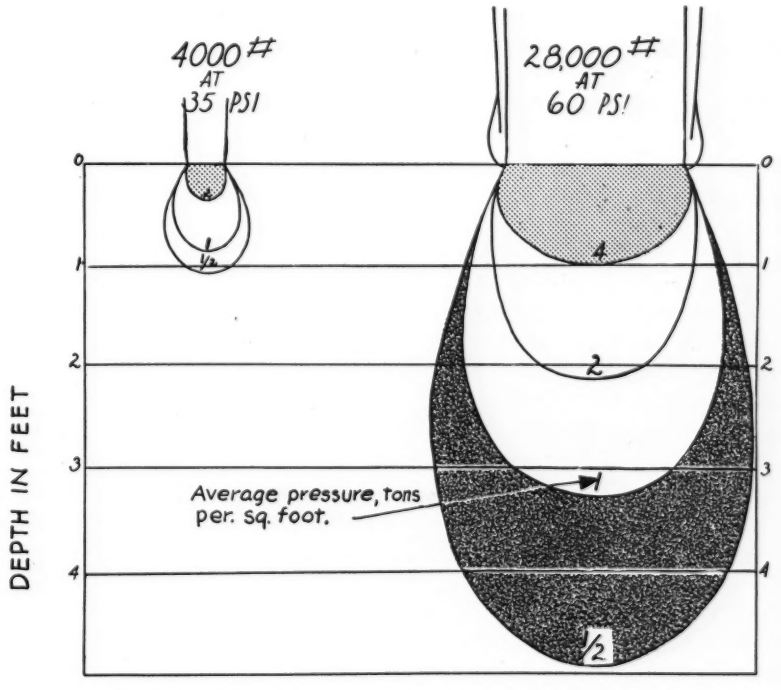


Fig. 3. Vertical pressures developed at various depths by pneumatic type rollers. Measurements in sandy soil.

depths, as found by theoretical computations. The pressure is a maximum as shown, depths being expressed in terms of the diameter (d) of the loaded area. Computations are based on two accepted methods; namely, assuming the loaded area below the surface is a truncated cone forming a 45° angle to the surface, or as tabulated by the Boussinesq equation.[2] The center curve of *Fig. 4* represents the estimated mean pressure based on the two theoretical curves.

Considering the information presented so far, the soils engineer should bear in mind that both shearing stress and vertical pressure are decreasing with increasing depth.

In connection with the subject of stresses, it might be of interest to reflect briefly on the time of duration of wheel loads. Investigations have shown that, considering only single wheel loads, the duration of maximum pressure at any individual point will be 0.3 second for slow-moving vehicles, and 0.06 second for speeds of 50 mph. The time factor presents the concept of inertia, or time required to get the soil mass in motion.

Trench backfill, that portion below the pavement base and above the bedding material, presents a somewhat different engineering problem from most in that we have no particular design criteria.

Density Control

The idea of controlling backfill replacement by density control is by far the most prevalent modern day method. However, the soils engineer should be cognizant of the fact that although a high density will produce a relative high stability for a specific material, this stability is no guarantee that it will be adequate to withstand applied wheel loads.

The important factors which must then be determined are the degree of compaction needed to prevent future densification and the minimum stability that will be required. Furthermore, since degree of compaction is defined as the ratio of densities of replaced and compacted material to the maximum density obtainable from a standard moisture density test, it is obvious that consideration must be given to the choice of the standard moisture density test.

Fig. 5 is an example of results of two standard moisture-density tests with different compaction effort for the same material. At the present time, most engineering organizations are using density tests which require a high compactive effort, i.e., California Impact or Corps of Engineers modified AASHO (American Assn. of State Highway Officials). For fills it is sometimes acceptable to reduce the compaction requirements below approximately the top 12 in. from the surface.

Many engineers acquainted with trench backfilling have indicated that the requirements for replacing the native material should be established by the density of the surrounding material. This may be a good suggestion, but there is at least one possible drawback. Remolded materials do not always have the same stability properties, and rarely have the same compaction properties as the undisturbed material. This is particularly true of clay soils with a high degree of structure, but is to a lesser extent true of most soils. Thus it is seen that if density is to be used as a control, a comprehensive series of investigations should be carried on to establish design criteria.

Other criteria for controlling backfill replacement have been tried. One of the most prominent of these is the penetrometer. The Proctor penetrometer and various types of cone penetrometers have been used with some fair amount of success to control density and stability. The penetrometer has some disadvantages such as size effects and human errors, but has at least one major advantage; more extensive testing can be carried on because of the relatively short time required per test. Again, investigations are needed.

In discussing any criteria to be used for backfilling, the engineer should always keep in mind that the type of soil being used may influence the criteria; for example, compaction in the top 12 in. to 95% modified AASHO may prove adequate for sands, while for clay 100% modified AASHO may be required.

It is obvious to the reader by this time that the author is not presenting answers to trench backfilling questions, but rather is attempting to stimulate thinking by engineers on the problem of backfilling trenches.

Soil Classification

As an objective to future investigations and research, it would seem desirable to establish a system of soil classification applicable to backfilling. Author Casagrande points out in an article in ASCE *Transactions*, June 1947, that possibly the best method of classification is one designed for a specific purpose.

There is at least one additional item of interest relative to the problem of backfills; namely, the rewriting of specifications. The general feeling is that specifications need modification and in many cases this would be a great help. But in general, any rewriting of standard specifications should proceed with caution until such time as additional information is available.

Trench backfilling is a construction problem in its own right and should be treated as such and not as a stepchild of the larger types of construction.

Since economy is so important, the ultimate aim of performance studies and laboratory tests should be to attempt to balance the cost with the structural requirements of the backfilled material. In this way the most benefit can be obtained from each dollar spent on utility type trenches.

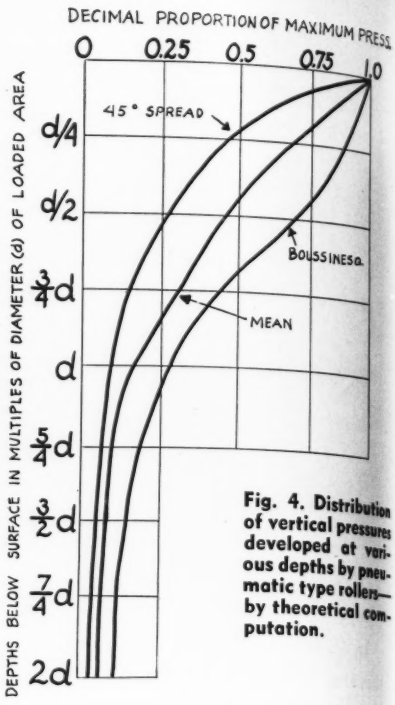


Fig. 4. Distribution of vertical pressures developed at various depths by pneumatic type rollers—by theoretical computation.

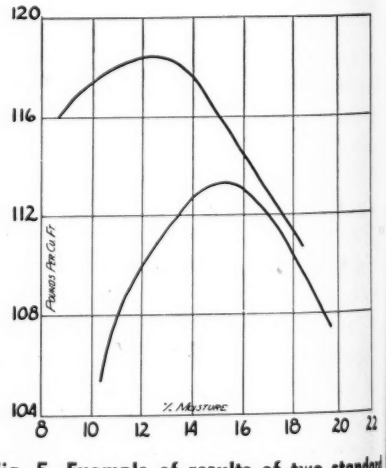
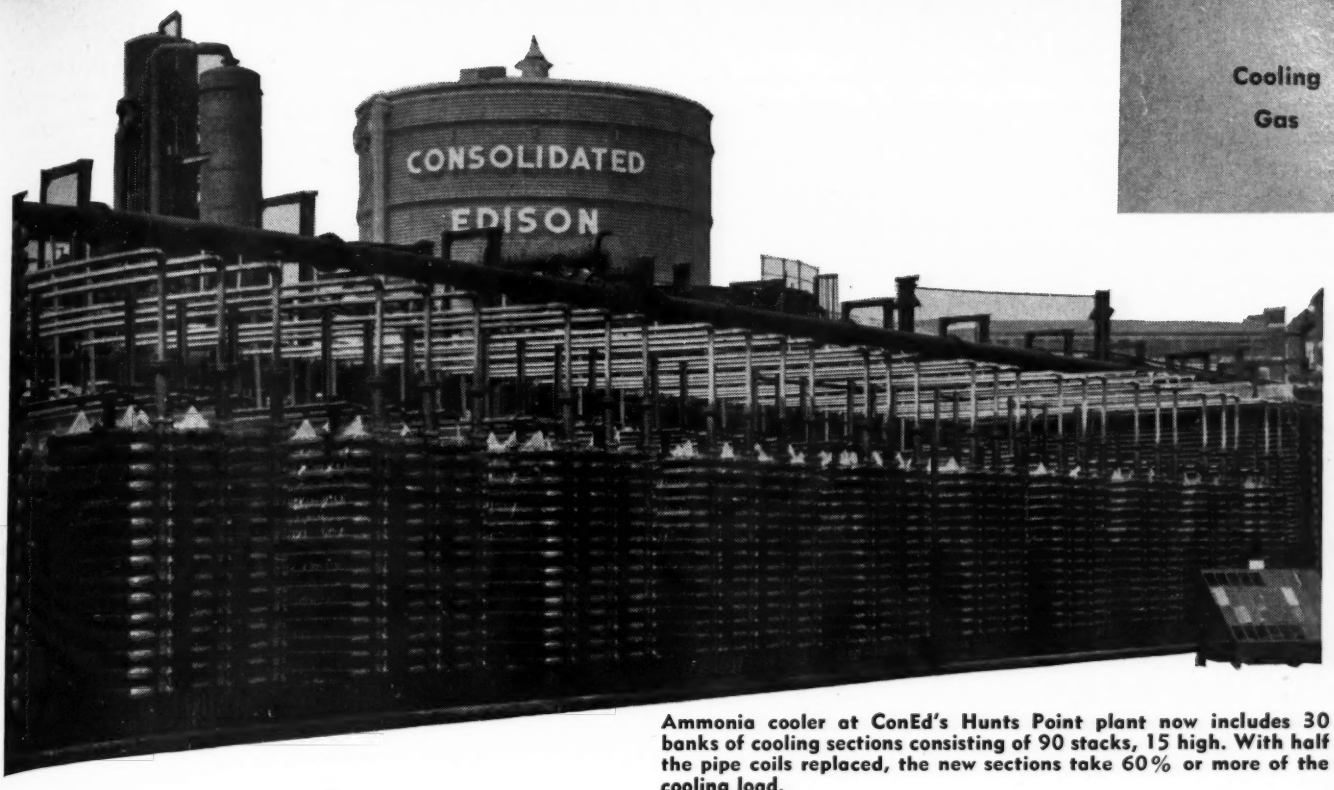


Fig. 5. Example of results of two standard moisture-density tests (with different compaction efforts) on the same soil.

[2]Taylor, D. W. Fundamentals of Soil Mechanics. Wiley 1948.



Ammonia cooler at ConEd's Hunts Point plant now includes 30 banks of cooling sections consisting of 90 stacks, 15 high. With half the pipe coils replaced, the new sections take 60% or more of the cooling load.

Cast Iron Cooling Sections Pare Costs, Repel Corrosion in Coke Plants

SUBSTANTIAL operating economies are being attained in the production of by-products at two eastern coke plants by progressive replacement of steel pipe coil cooling equipment for wash oil and ammonia liquor with gray cast iron cooling sections. The latter combine excellent corrosion resistance to the sea water used for cooling with high thermal efficiency and water utilization.

The net result is cooling equipment which is more compact, costs less to operate, and is easy to maintain. Another important consideration is the elimination of leakage of contaminated fluids to the cooling water, thus preventing pollution from this source.

Wash Oil and Ammonia

At both of these plants—the Consolidated Edison Co. Hunts Point coke plant, New York City, and the Everett (Mass.) plant of Eastern Gas & Fuel Associates—wash oil is used in the light oil recovery process and ammonia liquor is used for direct contact cooling of coal gas. At Hunts Point, the light oil recovery process includes the removal of objectionable naphthalene from the gas. In the production of coke, varying quantities of light oil are obtained per ton of coal processed. Desirable products are obtained from this oil by fractionation.

Changeover to the cast iron cooling sections is the result of experimental installation of a single bank of these sections in each plant in 1946 and 1947. These cooling sections are products of the National Radiator Co. Conversion to sections is being made in both plants progressively over periods of five or six years.

The Hunts Point plant had originally been equipped with steel pipe coils for cooling wash oil and ammonia liquor. Their average life on the hot end of the wash oil coolers was about two years. A test installation of sections was made in 1946 for this service. This original equipment is still in service as part of the present wash oil cooler which is now entirely made up of National sections.

The entire cooler was changed over during a period of 18 months in 1948 and 1949 as a maintenance operation, as a result of the reduction in maintenance expense demonstrated by the trial unit. There has been no maintenance replacement of as much as a single element thus far, even on the 1946 portion of the installation; nor has there been a single leak, the latter difficulty being a major difficulty with the pipe coils which would fail at the threaded connections at the ends, resulting in a serious pollution condition.

19 Stacks

This wash oil cooler now consists of 19 stacks each 24 sections high. Each stack replaced a bank of pipe coils consisting of 40 20-ft lengths of 2-in. pipe. The section coolers occupy less than one-third of the space formerly used by the pipe cooler. This unit is divided into a primary and secondary stage of approximately equal size, interconnected in series, and cools 6000 gph wash oil from

160° to 90° F with 73° sea water.

The ammonia liquor coolers are also being converted from pipe coils to sections as a result of the aforementioned experience. Starting in 1948, this unit is being revamped at the approximate rate of 12 banks of pipe coils (nine banks of sections) per year. Each bank of sections consists of three stacks in series 15 sections high. At present 30 banks of sections have been installed, with nine more secheduled for 1952.

In order to minimize interconnecting piping between the three stacks in each bank, the middle stack is connected for concurrent flow instead of countercurrent flow of water and ammonia liquor. In other words, the flow of ammonia liquor is from top to bottom in the middle stack instead of the normal flow from bottom to top. This arrangement permits the use of single cast iron flanged fittings without need for a downcomer pipe between stacks. In this installation no replacement has been made of a section or fitting since the changeover was started.

Sea Water Used

This cooler in its present transition stage (30 banks and 48 pipe coils) handles about 100,000 gph of liquor cooling at from 130° to 86° F in the summer with 73° sea water.

Cooling water for both the ammonia liquor and wash oil coolers is sea water pumped from the western end of Long Island Sound at a total rate of 5000 to 6000 gpm and treated with sodium hypochlorite to reduce algae deposit.

One of the main reasons for installations of this type is the corrosion resistance of cast iron. In addition to being exceptionally close-grained cast iron, National sections are protected against corrosion failure by substantial wall thicknesses, particularly at the turns. There are no threads to reduce this thickness since all bolting flanges are integral parts of each element.

High efficiency in heat transfer is attained by design features. Internal longitudinal ribs and swirler fins provide a large area of heat transfer surface and produce turbulent flow characteristics which not only increase heat transfer rate but also help to keep the interior of the sections scrubbed clean.

Externally, the sections are designed with a smooth surface which minimizes scaling and growth, and with small collector ribs on top and bottom. Collector ribs promote formation of cohesive films of water that fall off in curtains to the sections below with maximum wetting and minimum waste by splashing.

Metal that is kept constantly wet has a lower corrosion rate than when alternately wet and dry. Close vertical spacing between sections assists in maintaining a uniform water film, and a unit consisting of several closely spaced stacks of sections acts as its own wind break.

Small space requirement is another important consideration. This is demonstrated in the replacement of pipe coils where only a fraction of the original catch basin area is used. It is a direct result of the highly efficient interior fin design for high heat transfer.

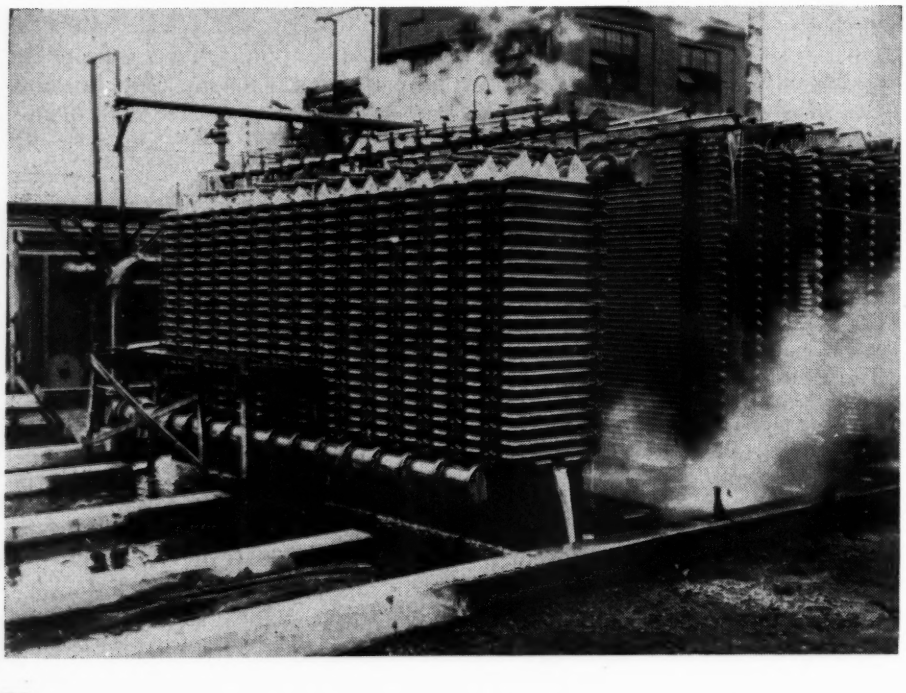
At the Everett coke plant of Eastern Gas & Fuel Associates, galvanized steel pipe coils had been used for cooling ammonia liquor with sea water from Boston harbor. The average life of these coils was 18 to 20 months, and they required constant attention because of leaks resulting from corrosion.

Test Installation

An initial test installation of National sections was put in service four years ago. It has operated continuously without signs of failure and with negligible maintenance. A program of replacing 50 banks of pipe coils with these sections was started in 1950. Ten banks were replaced that year and 10 more in 1951. The remaining 30 banks will be converted as rapidly as possible. Each bank consists of two series stacks 15 sections high and is designed to cool 45 gpm of ammonia liquor from 120° to 85° F. with 56 gpm of raw untreated sea water at 74° F raised to 87°. In winter, with water temperature of 35 to 36° F, flow rate is reduced.

The wash oil cooler at the Everett plant, since it was made of admiralty metal pipe, had given good service for 15 years. However, it was a single-stage cooler and not large enough to provide the desired final oil temperature in the summer. It reduced wash oil temperature from 212° to 95 to 90° in summer. To obtain an additional 15° of cooling would require 50% more surface with the same type cooling equipment because of the closer approach to entering water temperature.

A bank of sections, 15 stacks each 21 sections high, was installed at one end of the original catch basin. These coils required only as much space as two banks of pipe coils or about one-third of the space required for equivalent cooling by pipe coils. This unit was placed in series with the older unit last year, and is performing in accordance with the designers' expectations, cooling 29,000 gph of wash oil from 99° to 77° when using 59° sea water.



A bank of cooling sections consisting of 15 stacks, 21 high, has been added to admiralty metal pipe cooling coils for wash oil at Everett, Mass. plant of Eastern Gas & Fuel Associates. Note comparison between area required by cooling sections and large catch basin area, at left, formerly required by pipe coils.

Testing Cold Flow Properties of Coatings

Figs. 1 and 2. Blunt rod penetrometer developed for cold flow testing of bitumens, showing detail of detachable dial indicator.

Report of investigations made, using a recently developed instrument, under selected conditions of load, time, and temperature.

By CHARLES E. LEE
Southern California Gas Co.
Los Angeles

Southern California Gas Co. recently investigated some of the flow properties of commercially available and experimental pipe coating bitumens with the purpose of selecting the best materials for resisting deformation in service. The investigation resulted in new methods being used to predict the suitability of bitumens for pipe coating service and for quality control of shipments.

A BITUMEN that has satisfactory flow properties for pipe coating service would be resistant to the forces encountered in aboveground storage and handling operations, and capable of withstanding the varied soil forces and pressures over a period of many years. It was desired to determine the flow properties of a bitumen that would best meet the requirements for service and to describe them in the fundamental units of force, temperature, time, and distance.

There are several other requirements for coating bitumens. Among them are good impact strength at low temperatures, low water absorption, high electrical resistance, easy application to pipe, and low cost.

Inspections in recent years of the numerous types of coatings used by SoCal over about the last 25 years reveal that failures and deterioration of bituminous type coatings are predominantly due to cold flow at the conditions encountered in service. Yard wrapped pipe is stockpiled, loaded on trucks, transported, unloaded, sometimes stockpiled to be loaded and unloaded again, strung along the right-of-way, lowered into the ditch and backfilled.

During these operations even the best coatings are sometimes damaged and some coatings may be damaged extensively. The use of storage supports, handling slings and skids that do not have sufficient bearing area to compensate for the low resistance to flow of some coating materials accounts for a sizeable percentage of the early failures after burial.

The deterioration underground of bituminous coatings which were in good condition when buried is usually the result of some form of mechanical failure at the service conditions. Aging of the surface of some coatings may be evident in certain soils if the bitumen is exposed directly to the soil. However, due probably to the thickness of properly applied coatings, we have not been able to attribute any significant number of coating failures to aging alone.

The failure of a coating usually occurs on the bottom of the pipe. In a few instances the coating was observed to be pushed away from all of the bottom of the pipe presumably because of not being able to support even the weight of the pipe and backfill. These coatings were in service for several years but in soil that would exert only a moderate amount of "soil stress."

Uneven support of the pipe in the trench bottom tends to intensify stresses in the coating. Hard clods of clay, rocks of all sizes (but especially the pea-sized ones), pieces of pavement, and other foreign objects present in the trench bot-

Presented at the PCGA technical services conference at Fresno, Calif., March 5-6.

tom or backfill penetrate coatings due to the pinpoint pressure they exert. Coatings on pipe installed in parkways, lawns or across country are distorted and deteriorated by tree, brush and grass roots.

Soil stress, caused by the alternate swelling and shrinking of clay soils with changes in water content will mechanically destroy coatings if conditions are right. However, damage to coatings is restricted to areas where the soil dries enough at pipe depths to crack or distort the coating. It appears that many heavy soils, especially under pavements, do not become this dry.

The conditions of storage, transportation and handling and the results of improper methods and unsuitable materials are easily visualized. A minimum requirement is that the coating will not sag under the forces of its own weight at the highest atmospheric temperatures. Whitewash is effective in keeping coating temperatures down in the sun.

At low temperatures, impact-resisting properties of coatings become important. Prevention of damage to yard wrapped coating is better than patching in the field. Damage can be minimized by determining the flow properties of the bitumen, designing the handling equipment accordingly and exercising reasonable care and judgment in all operations.

Underground service conditions consist of forces, temperatures, times, and limiting distances. A minimum flow requirement for any coating bitumen is that it will not flow away from the bottom of uniformly supported pipe during periods of maximum ground temperature. The compressive stress in the coating on the bottom of uniformly supported pipe varies with the size and the wall thickness but is in the order of ¼ lb/sq in. Soil may be expected to weigh about 120 lb per cu ft and consequently to exert a compressive stress of about 0.8 psi per foot of depth.

Since the pipe is not uniformly supported in the trench bottom, and because of the presence of clods, rocks, roots, and other objects, the coating will have to withstand forces much greater than those exerted under uniform conditions if it is expected to be permanent. If a reliable criterion of the flow properties of the various coating materials is available, a material having the best properties and meeting other requirements can be selected.

Records of soil temperature at two locations in Los Angeles indicate that at pipe depth the soil may attain temperatures as high as 80° to 85° F during late summer months and a minimum of about 50° to 55° F during winter months. The maximum temperatures, even though they exist for only a short time, are the important temperatures where the resistance to deforming forces is of concern.

The number of years a pipeline is expected to operate determines the length of time that the coating will be required to resist ground forces. The minimum thickness of a coating determines the amount of deformation that can be tolerated.

A wide variety of asphalt and coal tar coating bitumens is currently in use by companies operating pipelines in California. Coating asphalts are usually of the air-blown type and the source, method of manufacture and the amount of air blowing, and also the amount and type of filler when used, determine the flow properties.

Coal tar coating materials, also of a

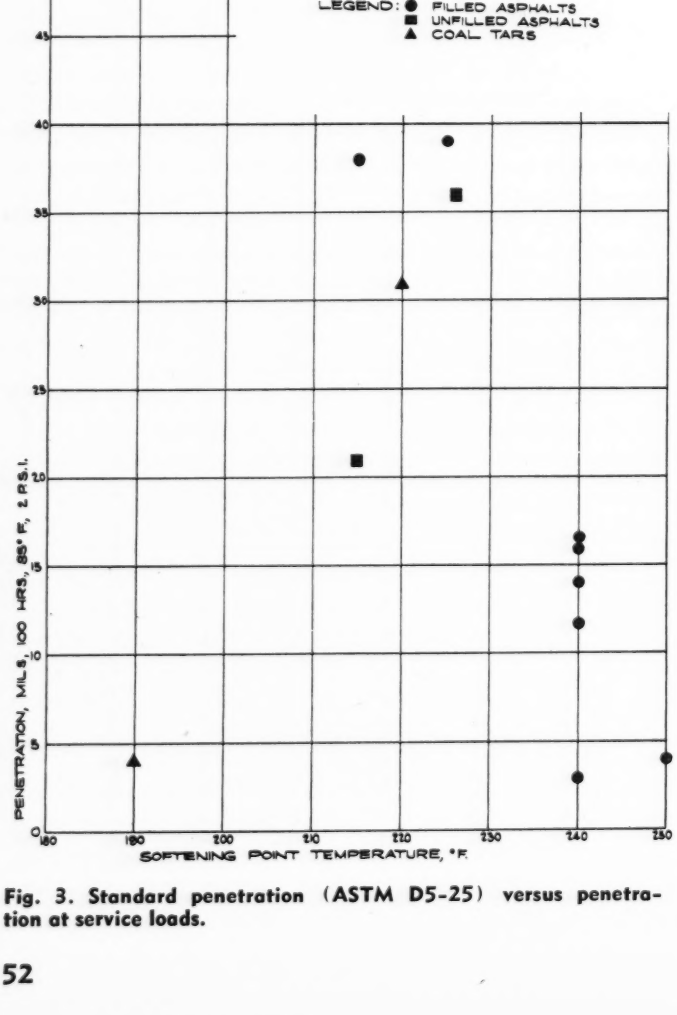


Fig. 3. Standard penetration (ASTM D5-25) versus penetration at service loads.

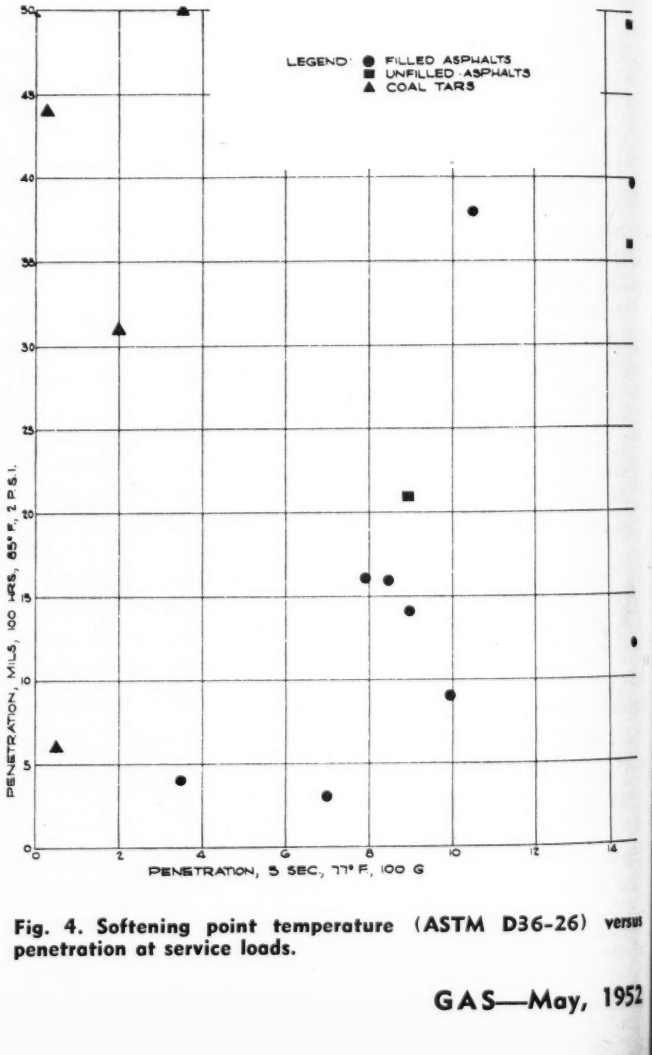


Fig. 4. Softening point temperature (ASTM D36-26) versus penetration at service loads.

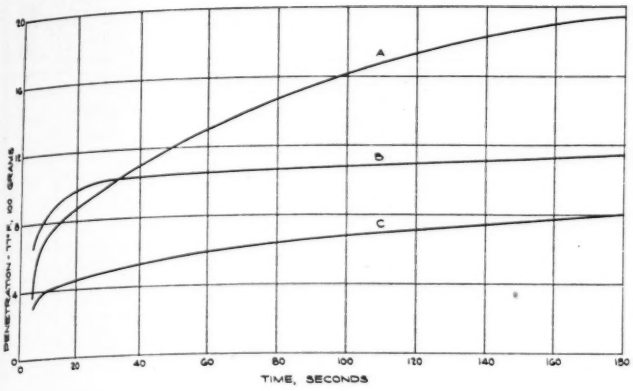


Fig. 5. Effect of time on ASTM penetration of bitumen.

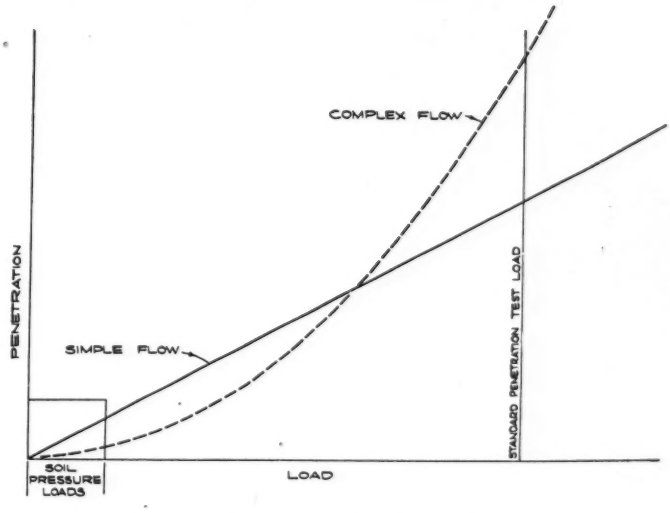


Fig. 6. Effects of load on flow of bitumens.

wide range of flow properties, are produced by several companies under familiar trade names. Shideler[1] classified the hot applied coal tar coating bitumens as narrow, moderate, and wide-range enamels, according to their flow characteristics.

At present, SoCal uses a "blunt rod" penetration test to determine the flow properties of bitumens at service conditions. This test (in addition to those controlling other properties) is used for purchase specification and quality control of shipments. It consists of subjecting the bitumen to selected conditions of load, temperature and time and, after considering the best available knowledge of the performance of bitumens after lengthy periods of service, deciding what flow conditions are acceptable and what are not.

The load is determined by the compressive stress likely to be exerted in the bitumen on the bottom of uniformly supported pipe buried about 2 ft deep. The temperature is determined by maximum temperature likely to be encountered in service. The time is sufficiently long to allow a material to exhibit its flow properties and to produce a measurable deformation but short enough to give results in time for quality control of shipments.

Specifically, the test consists of pouring a molten sample of the bitumen to a depth of about ⅛ in. in a shallow container about 2 in. in diameter, allowing it to cool in air for one hour, then placing it in a water bath at 85° F for one hour. While it is in the water bath, one end of a flat-ended ¼-in. diameter rod, weighted to exert a pressure of 2 psi, is placed on the surface of the bitumen.

An initial reading of the position of the rod and a final reading after 100 hours have elapsed are made, and the difference is recorded as penetration, mils, 100 hours, 85° F, 2 psi. *Fig. 1* shows a form of apparatus that has been used for these tests, and *Fig. 2* shows the detail of the detachable dial indicator used to measure the penetration at any time. Under presently applied standards a bitumen must have a penetration of not more than 10 mils to be acceptable.

The test to determine the flow properties at aboveground handling conditions is made in the same manner, except that the time is six hours and the temperature is 115° F. Under presently applied standards, a bitumen must have a penetration of not more than 20 mils to be acceptable.

The American Society of Testing Materials penetration (Designation: D5-25) and ring-and-ball softening point tests (Designation: D36-26) are commonly used by manufacturers of coating bitumens for quality control and identification of product, and to predict the suitability for service. Apparently it was a natural step for purchasers of the materials to use the same tests. However, it has been experimentally determined that the results of these tests cannot reliably be used to predict the flow properties of a pipe coating bitumen at the service conditions.

The "blunt rod" penetration of a number of coating bitumens (all but two are commercially available and extensively used) is shown in *Fig. 3* plotted against the more familiar ASTM penetration. It is evident that there is wide variance in the penetration at conditions of the "blunt rod" test, which approximate those encountered in service, for materials of nearly the same ASTM penetration. Also, it is evident that if two materials are being evaluated it is possible that their order of merit may be reversed depending upon the selection of test conditions.

The "blunt rod" penetration of most of the bitumens shown in *Fig. 3* are shown again in *Fig. 4* plotted against the temperature of the ring-and-ball softening point. It seems evident that the flow properties that are exhibited at the service temperatures are not always retained by the bitumen at the higher temperatures of the softening point. Consequently, the results of the ring-and-ball softening points give an incomplete picture of the flow properties of bitumens and cannot reliably be used for predicting serviceability.

The apparently conflicting flow data presented in *Figs. 1* and *2* possibly may be explained by a brief discussion of the fundamental flow laws and their application to the specific conditions involved. The flow of a material may be proportional to load and time (simple flow) or it may not (complex flow).

The type of flow is said to depend not only upon the material but also upon the temperature, time, and the intensity of the applied stress. Essentially, the ASTM penetration test is designed to exert a high stress on the bitumen and thus get a readable deformation in a short time for purposes of quality control during the manufacturing process.

In *Fig. 5*, the ASTM penetration of

[1]Shideler, N. T. "Hot Applied Coal Tar Coatings." *The Petroleum Engineer*, February 1951.

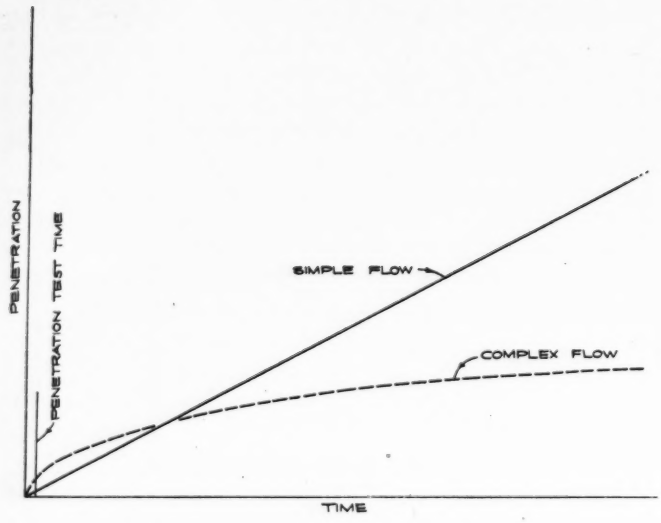


Fig. 7. Effects of time on flow of bitumens.

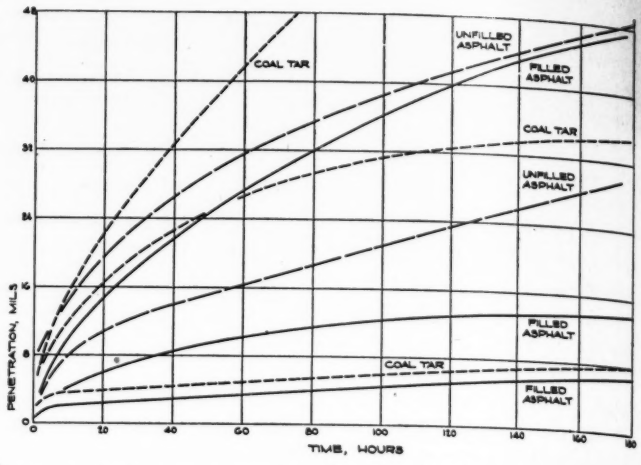


Fig. 8. Resistance to penetration at 2 psi load, 85° F temperature.

three commercial coating bitumens is shown. The standard time for the ASTM test is five seconds. At this time, material B has the highest penetration; materials A and C have lower and about equal penetrations. At a longer time, however, material A has a much higher penetration than either B or C. Thus, by merely changing the test time in the order of seconds, the apparent suitability of a material for service may be changed.

The initial load when the tip of the ASTM needle is applied to the surface of the bitumen is about 8000 psi. As the needle penetrates, the unit load is reduced due to the increased area of the needle. However, it is still very high. For example, at a penetration of 10 and based on the projected area of the needle, the unit load is about 1800 psi. In order to reliably predict the suitability of a bitumen for pipe coating service from the results of the ASTM test, it must behave according to simple flow laws over load ranges of from several thousand pounds per square inch to a few pounds per square inch and from a time of a few seconds to several years. Evidently this is unlikely.

The softening point temperature is said[2] not to be a reliable criterion for predicting what will happen at atmospheric and ground temperatures because for some bitumens states of complex flow that exist at these temperatures are not evident at the higher temperature of the softening point.

Two types of flow that were observed with changes in applied stress are illustrated in *Fig. 6.* A material may deform in proportion to load or it may exhibit elastic properties at the relatively low loads in the range of soil pressures and not exhibit them under the high stress of the penetration needle.

Two general types of flow of bitumens under equal load with increasing time are illustrated in *Fig. 7.* One material although exhibiting only slight deformation at first tends to continue to flow with time; the other may deform rapidly at first but build up a resistance to flow with time or reach some limiting condition due to elastic properties after an initial deformation.

The "blunt rod" penetration of seven commercial pipe coating bitumens and one experimental bitumen are shown in *Figs. 8* and *9.* The two unfilled asphalts are air-blown types. The one having the higher resistance to flow is an experimental material produced by prolonged air-blowing. The filled asphalts are from different sources and contain different types of mineral fillers in varying amounts. The coal tars are representative of the narrow, moderate, and wide range materials as classified by Shideler.

It seems that there is a rather wide range in the flow-resistant properties of materials in common use for similar service conditions. Some materials flow at a rate nearly proportional to time, while others flow at a decreased rate after an initial deformation. However, based on present knowledge, all of these materials deform continuously even at compressive stresses as low as the minimum likely to be found in pipeline service.

A comparison of the data in *Fig. 8* with those in *Fig. 9* indicates that some materials soften rapidly with increases in temperature. Because of the unknown effects of complex flow, it may be erroneous to predict the flow properties at one temperature from the results of tests made at a different temperature. It seems best to determine experimentally whether the bitumen has suitable properties at the highest service temperature.

Additional information about the complex flow properties of most pipe coating bitumens can be gained by making tests at a number of stress, time, and temperature conditions. The most reliable data are obtained when tests are made at or near service conditions.

Reliable flow data plus a background of experience with bitumens of known properties and a knowledge of the reinforcing and strengthening properties of internal and external wrappers are necessary if a durable coating for underground pipe is to be produced.

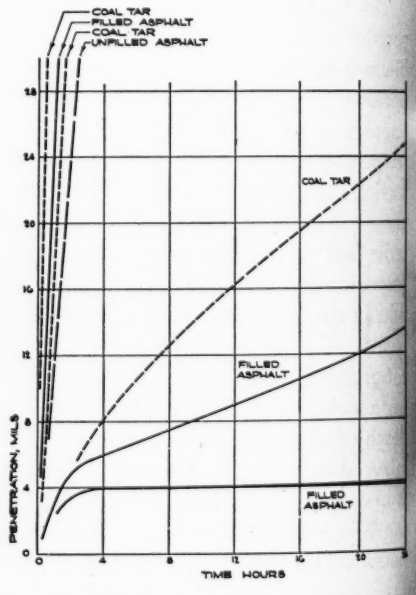
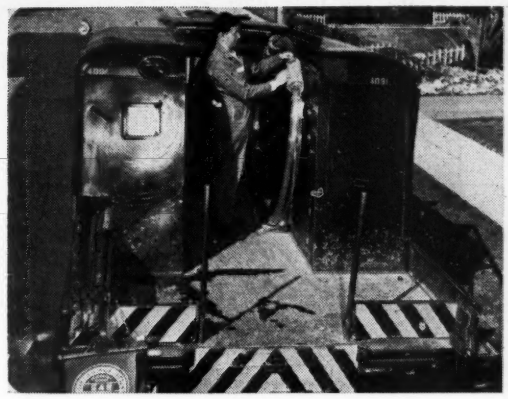


Fig. 9. Resistance to penetration at 2 psi load, 115° F temperature.

[2]Traxler, R. N. "A Review of the Rheology of Bituminous Materials." Reprinted from *Journal of Colloid Science*, Vol 2, No. 1, February 1947.



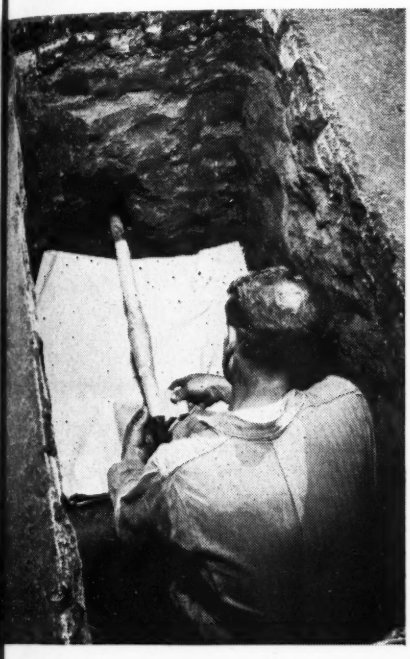
1. Coils in 200-ft lengths are transported carefully to job to prevent kinking.

2. Bell hole is drilled at main connection where tubing will be inserted.

How . . .

Plastic Tubing is Inserted in Old Steel Services

The survey published last month on plastic tubing uncovered a great deal of interest in the application of the tubing for service replacement, using old pipe as casing. As a postscript, and complementary to the article by Gordon Dye on Southern California Gas Co.'s experiences with plastic pipe, this picture page shows the techniques employed by the Los Angeles utility in making the installation.



3. Leading end of ½-in. tubing is plugged before being pushed carefully through old steel casing.

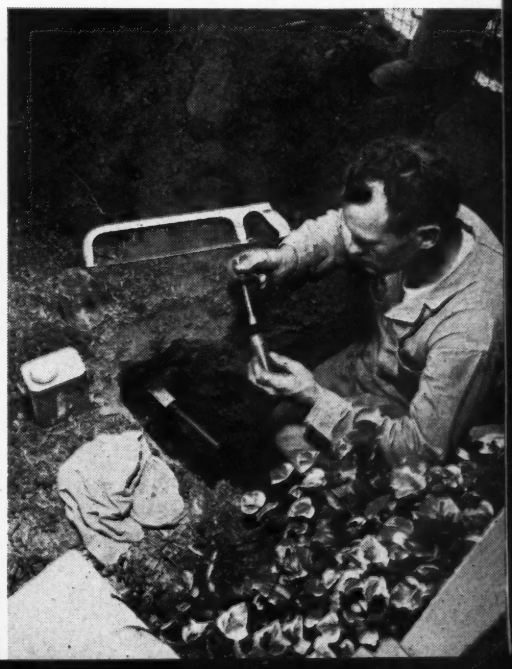
4. Butyl acetate is used to cement plastic adaptors to each end of tubing after it has been cut to length.

5. Plastic protection nipples with one end belled, cemented to adaptors, protect pipe from shearing.

6. Existing service at main is used wherever possible, with normal procedures being followed.

7. Pipe connections at both ends are wrapped securely, and two heavy coats of grease are applied.

Courtesy *SoCal Gas News Pictorial.*



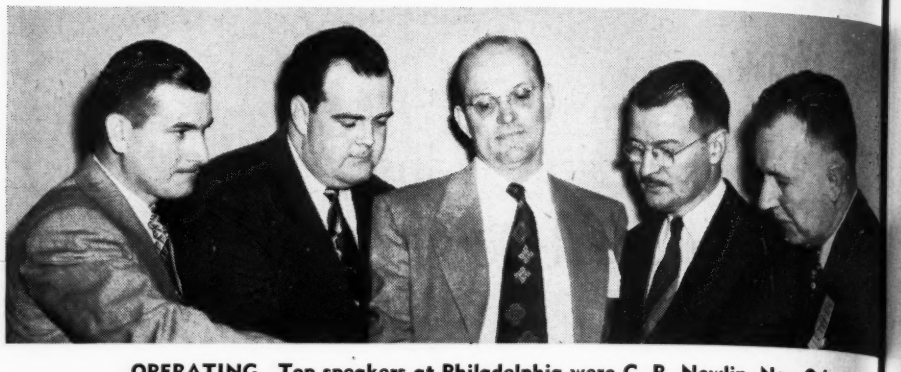
Spring Tonic

When spring comes, after a long tough winter of facing peak loads and their attendant problems, gasmen heave a sigh of relief and reach for the tonic. They're more than a tonic—they're a shot in the arm, these many conferences and conventions that crowd the calendar from mid-March to the end of May. Salesmen who are in need of inspiration and reassurance, distribution engineers troubled with leakage and fast meters, pipeline men ready for another summer of beefing up their systems, all find new hope and new answers to their questions at these meetings.

Of the three months, April is the heaviest, with no less than 10 conferences of national or top regional interest being held—not to mention the many sectional conferences of the regional associations.

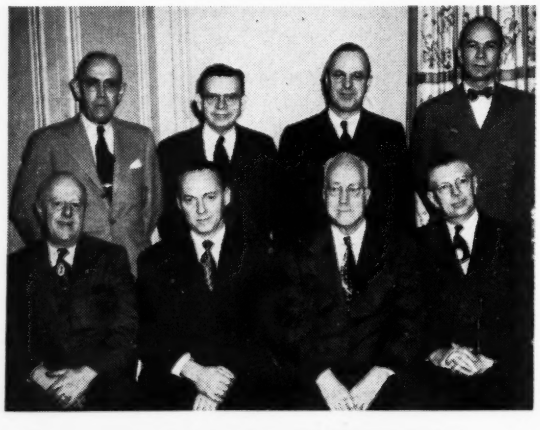
These pages show pictorially a cross-section of seven of these most important meetings.

OPERATING. First general session at Philadelphia featured H. B. Andersen, Philadelphia, operating section chairman; H. W. Reed, Philadelphia; J. A. Whelpley, Cincinnati; H. Carl Wolf, AGA; F. H. Bunnell, Jackson, Mich.

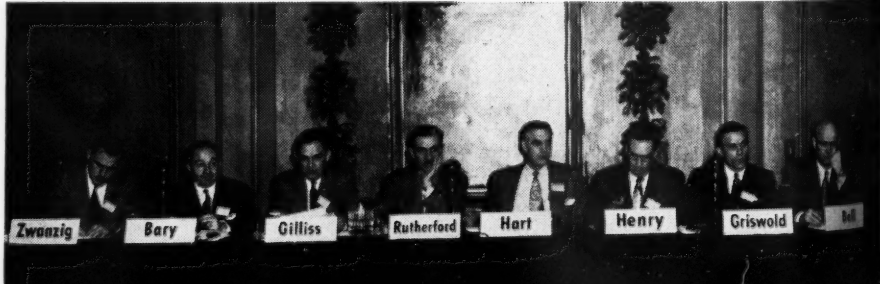


OPERATING. Top speakers at Philadelphia were C. R. Newlin, New Orleans; F. A. Sharkey, Philadelphia Gas; G. K. Bachmann, Newark; H. M. Banta, Battelle (Columbus). J. M. McCaleb, Columbia Gas, Columbus (right), presided.

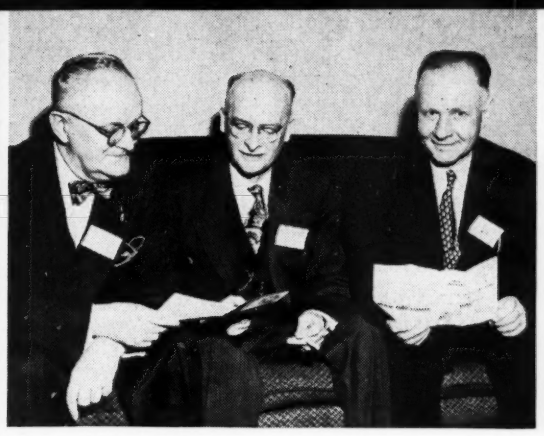
OPERATING. Chairmen of the three sections which met in Philadelphia April 7-10: A. D. Simpson, United Gas, Houston, corrosion committee; J. A. Whelpley, Cincinnati, distribution; W. E. Albright, Philadelphia, motor vehicles.



NEGA. New officers: (seated) Otto Price, Boston, treas.; S. R. Knapp, Berlin, Conn., pres.; G. G. Howie, Cambridge, ex-pres.; J. L. Johnson, Providence, 1st v. p.; (standing) J. A. Hiller, past pres.; H. C. Moore, Cambridge, asst. treas.; R. E. Wright, Cambridge, 2nd v. p.; Clark Belden, clerk.

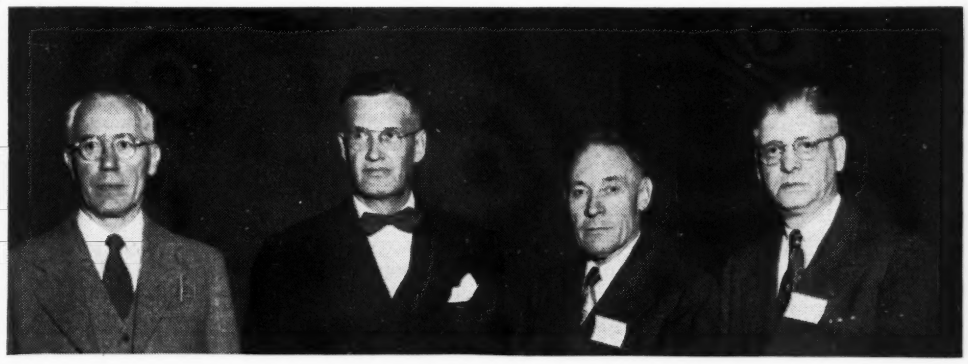


NEGA. Heating load panel: O. E. Zwanzig, AGA; C. Bary, Philadelphia; W. W. Gilliss, Washington; R. J. Rutherford, Worcester; Terry Hart, Nashville; H. M. Henry, Cambridge; G. G. Griswold, Brooklyn; R. A. Bell, Toledo. Standing, G. G. Howie.

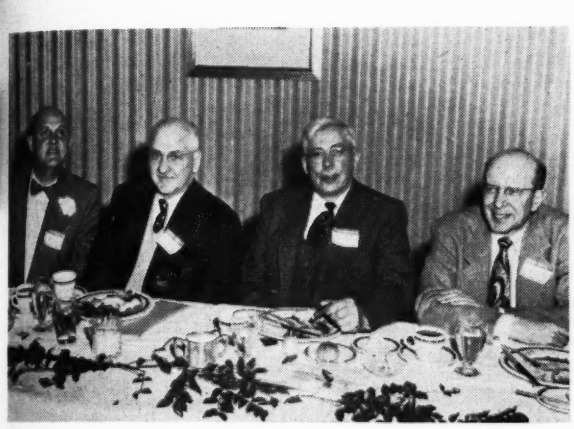


INDUSTRIAL-COMMERCIAL. Meeting at Cincinnati April 16-18, AGA leaders included (left) R. A. Malony, Bridgeport, chairman; Terry Hart, Nashville, vice chairman; (center) S. T. Olinger, Cincinnati; Ralph Manier, Syracuse; E. V. Bowyer, Roanoke; (right) John Black, Allentown, and L. J. Fretwell, Tulsa.

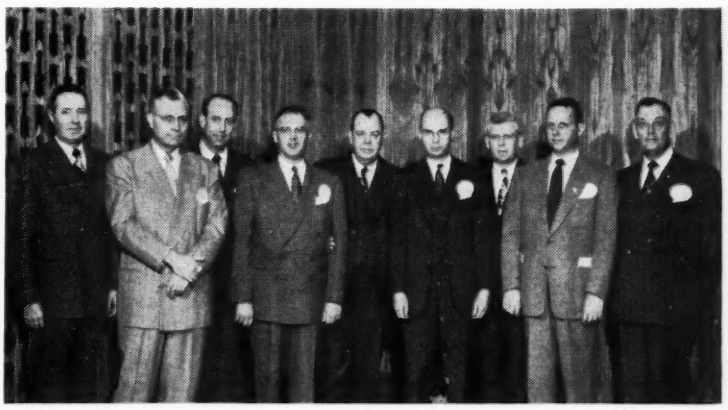
NACE. Corrosion expert Starr Thayer, Houston, was awarded Frank Newman Speller award by the corrosion group at Galveston.



INDUSTRIAL-COMMERCIAL. H. M. Heyn, Toledo; J. R. Delaney, Cincinnati; R. H. French, Chatham, Ont.; R. S. Wenner, Columbus, Ohio.

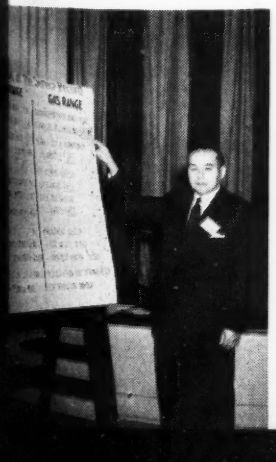


MIDWEST GAS ASSN. At Minneapolis, March 31-April 2, new officers are M. B. Cunningam, Iowa Power & Light, Des Moines, 2nd v.p.; E. E. Baxter, Central Electric & Gas, Lincoln, Neb., 1st v.p.; A. H. Abbott, Northern States Power, Minneapolis, president; H. E. Peckham, Northern States, St. Paul, secretary-treasurer.



OKLAHOMA UTILITIES ASSN. In Oklahoma City, March 27-28: H. W. Pitzer, Chackasha; W. R. Wolfe, Oklahoma City, 1st v. p.; R. W. Camp, Oklahoma City, pres.; E. J. Newlin, Oklahoma City, 2nd v. p.; D. A. Hulcy, Dallas; H. H. Young, New York; D. R. McClung, Washington; R. R. Suttle, SGA, Dallas; R. K. Lane, Tulsa.

EASTERN NATURAL GAS SALES MEETING. At Pittsburgh, April 7-8: (left) Julius Klein, Caloric Stove, Philadelphia; dealer panel included I. R. Jensen, Chicago; Mary Huck, Columbus; E. W. Hodgetts, Cincinnati; J. G. Berwanger, Columbus; Lee Corn, Cleveland, presiding; (far right) W. H. Ligon, Nashville.



ASSOCIATIONS

Reports

NEGA Member Companies See New Natural Gas Era

With the coming of natural gas to New England, utility companies of the region have "their greatest opportunity for rendering public service," members of the New England Gas Assn. were told at their annual meeting, held March 27-28 in Boston.

The opportunity, Louis Ruthenburg, president of GAMA and chairman of the board of Servel Inc., told the group, lay in a possible swing to gas home heating and "all-gas homes" and in wider use of gas as a fuel in industry.

As to the potential use of gas by industry in New England, he said that in 1950, in the nation as a whole, 54.5% of gas sales were made to industry, while only 16% of New England sales were to industrial plants, in spite of the heavy concentration of industry in this area. Increased natural gas supplies could alter this picture, he related.

Speaking in place of George F. Mitchell of Chicago, president of the American Gas Assn., who died March 26, E. H. Eacker of Boston, vice president of AGA, said gas utility companies must have higher rates to offset rising operating costs if they were to continue to serve the public efficiently.

"Several important manufactured-gas companies converted to natural gas distribution in the past few years to escape the inevitable rising cost of gas-making fuels," Mr. Eacker said. But the savings effected through lower manufacturing and distribution costs through conversion are being dissipated, as the cost of natural gas to the gas utility company is rising steadily.

Emphasis on a new era for New England gas was keynoted in a talk by Gordon Howie, vice president, Cambridge, Mass., Gas Light Co., and outgoing NEGA president. Utilizing charts to point up his speech, Mr. Howie traced the dramatic rise of manufactured, natural and L. P. gas sold by gas utility companies. Showing the growth that took place in New England from 1942-1950, he indicated that number of consumers increased from 1.44 to 1.64 million, sales of gas increased from 289.9 to 409.7 million therms, and revenues increased from $57.8 million to $102.5 million.

Mr. Howie further declared that New England received its first natural gas in 1951 and as more and more companies begin to use it, the record of sales will show an accelerated percentage of increase.

Outline of the steady growth measured by the association was presented by Clark Belden, NEGA managing director. Noting that a new high of 1323 individual members had been recorded, Mr. Belden declared that this figure had nearly doubled since 1940 when the association claimed 732 members.

Other speakers participating in the conference and their subjects were:

Herman Koester Jr., W. Wirt Young & Associates Inc., "The Importance of the Industrial Load to New England";

R. H. Coleman, safety supervisor, Consolidated Gas Electric Light & Power Co. of Baltimore, "Promoting Safety in the Company";

Wayne E. Keith, training supervisor, New England Telephone & Telegraph Co., "Personal Training and Development";

Richard B. Barger, assistant superintendent in charge of customer service, Hartford Gas Co., "Meeting Service Requirements of Customers";

Edward H. Cooley, president, The Cooley Associates, "American Business As It Is Viewed Abroad";

C. George Segeler, utilization engineer, AGA, "Using the New Gas Installation Standards";

Albert P. McNamee, manager home appliance marketing, *McCall's* Magazine, "Mass Market Merchandising"; and

A. C. Neal, first vice president, Federal Reserve Bank of Boston, "New England's Possibilities for Growth."

Of intense interest to those attending the conference was the panel session covering "Problems and Possibilities of the Residential Central Heating Load." With R. J. Rutherford, president, Worcester Gas Light Co., acting as moderator and a highly competent group of industry representatives as a panel, a brisk and lively discussion ensued. Covered were such aspects of the main topic as load forecasting, economics, rates, and sales from both the utility and manufacturing viewpoint with many participating from the floor in this final event of the conference.

Officers elected for 1952-53 were Sherman R. Knapp, Connecticut Light & Power Co., president; Jess L. Johnson, Providence Gas Co., 1st vice president; Roy E. Wright, NEGEA Service Corp., 2nd vice president; Otto Price, Boston Consolidated Gas Co., treasurer; and Clark Belden, NEGA managing director, clerk. H. Dorothy Keller, Blackstone Valley Gas & Electric Co., was named chairman of the home service group executive committee.

Fontana Elected President At NACE Convention

Mars G. Fontana

Newest findings in U. S. industry's fight against corrosion were revealed and discussed in symposium gatherings when more than 1200 engineers from dozens of industries assembled for the annual conference and exhibition of the National Assn. of Corrosion Engineers in Galveston, March 10-14.

Multi-million-dollar research by oil, gas, and other industries is developing successful measures in cutting down the annual U. S. corrosion bill of more than $6 billion, and 33 papers presented in nine symposia at the NACE conference cited some of the salient techniques in battling corrosion.

Mars G. Fontana, professor of metallurgy at Ohio State University, took office as the ninth president of NACE, which has more than 3200 members in 44 states and 26 foreign countries. Also taking office were Walter F. Rogers, Gulf Oil Corp., Houston, vice president; and Russell A. Brannon, Humble Pipe Line Co., Houston, re-elected treasurer. A. B. Campbell; Houston, is executive secretary. New directors are H. P. Godard, Aluminum Laboratories Ltd., Kingston, Ont.; V. V. Kendall, National Tube Co., Pittsburgh; Norman Hackerman, University of Texas, Austin; and L. L. Whiteneck, Board of Harbor Commissioners, Long Beach, Calif.

Awards presented at the meeting included the Frank Newman Speller award for achievement in the field of corrosion engineering to Starr Thayer, Houston corrosion consultant, and the Willis Rodney Whitney award for outstanding work in the field of corrosion science to Earl A. Gulbransen, advisory engineer to Westinghouse Research Laboratories, East Pittsburgh, Pa.

Assemblies were at the Buccaneer hotel on the beach, and in the Marine room of the Pleasure Pier. Housed on the pier were more than 100 exhibit booths, displaying the products and services of engineering and manufacturing companies.

Biggest Mid-West Group Hears Varied Program

"One of the greatest responsibilities of our industry leadership is to challenge the attention of the public and to explain the underlying fundamental principles upon which our industry is built," Larry Shomaker, Mid-West Gas Assn. president, told members of the group as he opened the 47th annual meeting in Minneapolis on March 31.

A record registration of 438 topped last year's high for the three-day event. Fifty-three new members brought the association's roster to 523 as the convention opened.

At the first general session, A. B. Cameron, Ruud Manufacturing Co., told "Why Gas Companies Should Aggressively Promote Gas Water Heater Sales" and, in the same vein, Lyle C. Harvey, Affiliated Gas Equipment Inc., discussed "What Utilities Can Do to Build Sales."

Betty Jane Frahm, Montana-Dakota Utilities Co., presented a home service skit and also presided at the home service luncheon. Among other speakers and topics were Chester L. May, Lone Star Gas Co., "Management's Responsibility in Connection With Merchandise Sales"; Harold E. Jalass, Cribben & Sexton Co., "Superiority of the Gas Range Over Its Competitors"; Judson S. Sayre, Bendix Home Appliances, "Selling the Gas Clothes Dryer Is a Must"; and John F. Merriam, Northern Natural Gas Co., "The Natural Gas Supply Situation."

Amos H. Abbott of Northern States Power Co., Minneapolis, was elected president of the association, and E. E. Baxter, Central Electric & Gas Co., Lincoln, Neb., was named first vice president. The new second vice president is M. B. Cunningham, Iowa Power & Light Co., Des Moines. H. E. Peckham, Northern States Power, St. Paul, was re-elected secretary-treasurer.

Bennett and Smith Named To Head Association

Charles E. Bennett, president of Manufacturers Light & Heat Co., Pittsburgh, and vice president of the American Gas Assn., has been elected president of AGA by the executive board. Mr. Bennett succeeds the late George F. Mitchell, who died March 26 while serving as association president.

At the same time, Frank C. Smith, president of Houston Natural Gas Corp., was elected vice president of AGA.

Mr. Bennett, who has been president and director of Manufacturers and its affiliates

C. E. Bennett

F. C. Smith

since 1935, has been active in the American Gas Assn. for many years. At the time of his election as president, he was serving as chairman of the natural gas department, vice chairman of the laboratories managing committee, and chairman of the executive committee on safety.

Mr. Smith, a director on the AGA executive board since 1946, was chairman of the general promotional planning committee last year, was vice chairman of the PAR committee in 1950, and is a member of the executive committee. He is also a past president of the Southern Gas Assn. and serves on the Institute of Gas Technology's board of trustees.

Record Attendance Scored By Oklahoma Association

The important role of U. S. production know-how was emphasized by Walker L. Cisler, president of Detroit Edison Co., who spoke at the 34th annual convention of the Oklahoma Utilities Assn. which convened March 27-28 at the Biltmore hotel in Oklahoma City.

"It is an attempt to duplicate this power to produce that causes other people to strive toward the things that have made our country great," he said.

Other speakers at the gathering were Harold H. Young, Eastman Dillon & Co., New York; D. A. Hulcy, Lone Star Gas Co., Dallas; and R. K. Lane, Public Service Co. of Oklahoma, Tulsa.

Mr. Young referred to eastern misconceptions which have cost the state of Oklahoma investment dollars. He urged utilities to adopt an educational program to inform potential investors about the area.

Mr. Hulcy praised the free enterprise system and declared that the foremost asset of the southwest in securing new industry is in the ambitious spirit of its people, a factor he placed above cheap gas, power, or low taxes in reaching the industrialization goal.

Mr. Lane told of the public utilities' share in the industrial development of Oklahoma. His company, he said, had spent considerable time and money in making business and research surveys in the state and in utilizing the facts gathered to bring new and bigger payrolls to the state.

Delegates toured Oklahoma Gas & Electric Co.'s new electric generating plant near Oklahoma City. D. S. Kennedy, president of the company, explained the importance of gas turbines in the system.

Attendance at the convention hit a peak for recent years with 368 registered and 485 attending the banquet, at which Kenneth McFarland, General Motors Co., Topeka, was the speaker.

New division chairmen of the association are H. C. Webb, Tulsa, gas; Paul Hoheisel, Oklahoma City, electric; and L. E. Babcock, Oklahoma City, accounting.

Tax Committees Formed

To assist member companies with tax problems, particularly those connected with the excess profits tax act of 1950, AGA has set up two committees and two subcommittees. Robert A. Hornby, Pacific Lighting Corp., San Francisco, heads the 12-member committee of executives on taxation. It will be assisted by a taxation accounting committee of 46 members, headed by Burton P. Smith, Texas Eastern Transmission Corp. The subcommittees deal with excess profits tax regulations and proposed and introduced federal tax legislation.

More than 200 heating contractors and technicians attended a training school held recently in Denver under the sponsorship of the National Warm Air Heating Assn. of Cleveland. Guy A. Vorhees, who conducts the association's conferences, instructed the sessions on perimeter and small pipe heating. The Denver Indoor Conference committee cooperated in promoting the school.

Wage schedules and employment conditions were surveyed at the recent AGA Midwest Personnel Group meeting at Tulsa. Among topics covered were procedures in connection with filing wage applications, company-financed physical examinations for department heads and key personnel, bonuses, retirements, and wage stabilization regulations. H. R. Shepherd, director of industrial relations, Cities Service Gas Co., presided.

H. Charles Pierce, assistant sales manager of the air conditioning division, Servel Inc., Evansville, Ind., was elected chairman of the newly organized engineering committee of the residential air conditioning section, Air Conditioning and Refrigerating Machinery Assn., at the group's recent New York meeting. The objective of his committee, according to Mr. Pierce, will be to establish application engineering standards on residential air conditioning for the entire industry.

Speakers at the National Conference of Electric and Gas Utility Accountants meeting April 7-9 in New York included Charles E. Oakes and Kinsey M. Robinson, respective presidents of Pennsylvania Power & Light Co. and Washington Water Power Co. The 1200 accountants who attended also heard "Development of Management Employees" by E. R. Eberle, Public Service Electric & Gas Co., and O. K. Boyd, Consolidated of Baltimore, who presented a progress report on a newly suggested classification of accounts.

A two-year graduate study program, leading to a masters degree in gas technology and to a doctors degree in two more years, has been developed by Dr. Joseph D. Parent and

JOHN B. O'CONNOR, executive vice president of Dresser Industries Inc., was host at a recent friendship luncheon held in Dallas to honor Sen. Antonio J. Bermudez, director general of Petroleos Mexicanos (Pemex), Mexico's government-operated oil organization. Shown at the Adolphus hotel are (from left) Robert W. Windfohr, Texas Mid-Continent Oil & Gas Assn.; R. B. Anderson, Waggoner Estates, Vernon, Texas; Senator Bermudez; H. N. Mallon, Dresser president; Mr. O'Connor, and Jose Colomo, assistant to Senator Bermudez.

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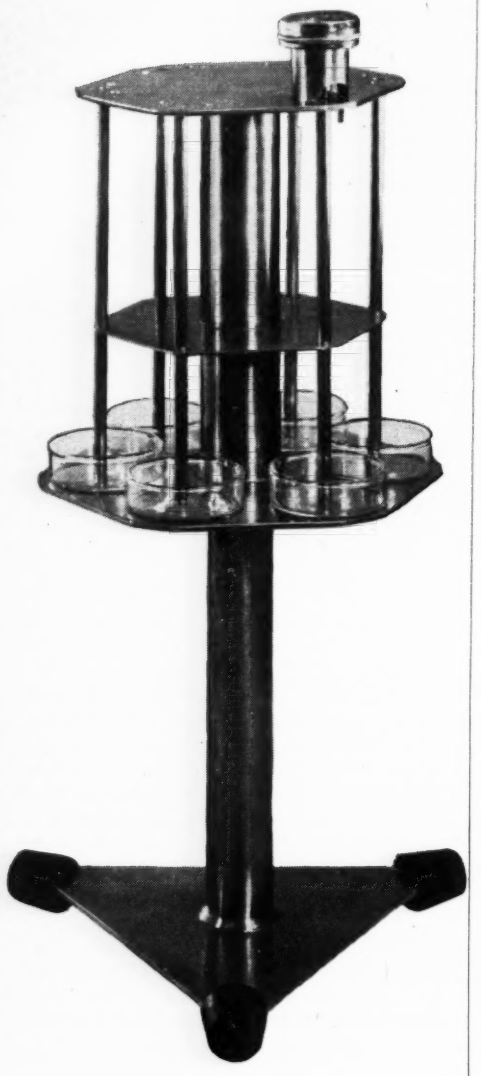

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his associates at the Institute of Gas Technology in Chicago. The program was reported at the AGA Great Lakes Personnel Conference which met recently in Chicago. A home study course including engineering and geological fundamentals, gas production and treatment, fundamentals of pressure, and underground storage will be announced soon.

At the joint annual convention of the Florida-Georgia Gas Assn. and the Florida Liquefied Petroleum Gas Assn., held April 3-5 in St. Petersburg, the former group elected the following officers: Francis Middleton, Clearwater, president; Alvan H. Stack, Tampa, vice president; and Robert E. Gresimer, Jacksonville, secretary - treasurer. Principal speaker at the meeting was D. A. Hulcy, Lone Star Gas Co., Dallas.

Sidney Feldman has replaced John J. Hassett as special writer on the AGA public information staff. Mr. Feldman, who will concentrate on national publications for AGA, has been a regular contributor to a number of publications and was once editor of *Safety*, magazine of the Greater New York Safety Council.

This Month

Safety, Interchangeability Topics at AGA Conference

Among subjects listed for discussion at the AGA Production and Chemical Conference, to be held May 26-28 in New York, are safety and interchangeability of substitute gases with natural.

At the first day's sessions, H. Carl Wolf, AGA managing director, will discuss "The Changing Production Scene," and Hall M. Henry, NEGEA Service Corp., and J. W. Carroll, Philadelphia Electric Co., will talk about the "Economics of Peak Shaving." J. L. Turnan, Worcester Gas Light Co., will preside over a panel on public safety, and Glenn M. Hammond, Michigan Consolidated Gas Co., is scheduled to summarize problems met in operating standby high-Btu oil gas plants.

Gas production research progress under the PAR plan is to be reviewed by F. J. Pfluke, Rochester Gas & Electric Corp., and two men from the Institute of Gas Technology, Chicago, have prepared a report on gasification of pulverized coal in suspension. Other IGT work to be discussed includes production of oil gases as substitute for natural, influence of substitute of gas compositions on interchangeability with natural, and improvement of catalysts and catalyst supports.

A group from the U.S. Bureau of Mines will present preliminary operating results of an experiment in pressure gasification using pulverized coal and oxygen. The work is being conducted at a pilot plant at Morgantown, W. Va.

On the second day, the chemical and gas production groups will hold separate sessions. Features at the chemical meeting are to include a paper on determination of water vapor in natural gas by a direct chemical method, by W. F. Brickell, United Gas Pipe Line Corp.; "Natural Gas Pipeline Deposits," by L. T. Bissey, Pennsylvania State College; "Chemicals From Natural Gas," by D. T. MacRoberts, United Gas Pipe Line; "Prevention of Pollution by Oil," by Charles Koons, Koppers Co. Inc.; and "Air Pollution," by J. F. Barkley, Bureau of Mines.

Scheduled for the gas production session are the following speakers and topics: J. M. Beisty, Brooklyn Union Gas Co., "Underfiring Coke Ovens With Straight Natural Gas"; E. V. Schulte, Koppers, "Recent Developments in By-product Recovery Equipment"; Dr. Frank W. Smith, Bureau of Mines, "What Makes Coal Coke?"; Dr. E. H. Smoker, United Gas Improvement Co., "Recent Developments in Cyclic Catalytic Reforming"; and John Sholar, South Carolina Electric & Gas Co., "Effects of Scrubbing High-Btu Gases."

Safety talks will be presented at each of three Tuesday luncheon conferences devoted to oxygen in gas manufacture, plant waste disposal, and water gas. On Wednesday, luncheon conferences will deal with carbonization and coke, chemistry in the gas industry, high-Btu gas, and liquefied petroleum gas.

At the last day's general session, W. H. Kramer, Phillips Petroleum Co., will tell why "Sound Engineering Spells Safety in L.P. Gas Plants." Training of personnel for operation of such plants is scheduled as the topic of S. C. Symnoski, Philadelphia Gas Works Co. Dr. O. W. Lusby will describe oil fogging equipment used by his company, Consolidated of Baltimore.

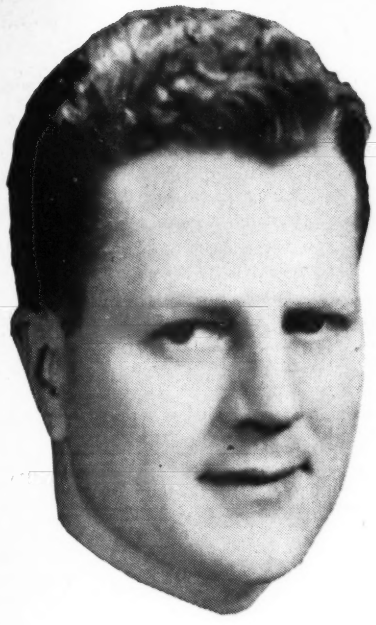
Controlling nuisance odors at odorization stations will be described by Paul L. Covell, Minneapolis Gas Co., at the same general session. In addition, reports for the builders and the tar dehydration subcommittees will be submitted by C. A. Schlegel, United Engineers & Constructors Inc., and Herman Laudani, Malden & Melrose Gas Light Co., respective chairmen.

Measurement Short Course Set For May 27-29

More than 85 subjects are set for presentation at the 27th Southwestern Gas Measurement Short Course sponsored by the college of engineering, University of Oklahoma, to be held at Norman, Okla., May 27-29. All sessions will be held in the drill hall building on the north campus of the university.

Twenty-three manufacturers and distributors of equipment were listed on the program when it was printed about two months before opening of the course, and doubtless more will be added to the list before the sessions open. As in former years, the course will include general sessions in the forenoons and lectures, papers, and demonstrations covering problems pertaining to the measurement and regulation of gas in the afternoons.

The general assembly program on the opening day will include addresses on "Aims and Operations of the Gas Measurement Short Course," by W. H. Carson, dean of the college of engineering, University of Oklahoma; "Address of Welcome" by Dr. G. L. Cross, university president; an address by J. F. Merriam, president, Northern Natural Gas Co.; and a summary of this year's activities by T. S. Whitis, program committee chairman.



"Playing nursemaid to a water heater cuts everybody's profit"

says E. P. Knapp,
Bryant Gas Equipment Corporation,
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Certainly it makes good sense today to *save* a dollar on product cost when you can. But when that product isn't *right*, the old army game of *passing the buck* begins. Then, everybody is the loser. That's why the market for Bryant Blue Seal Water Heaters is growing every day in my territory. All along the distribution line it's common knowledge that once a Bryant is installed, service problems end and everybody profits. My dealers and the utilities profit because they are not called upon to make costly service calls. Homeowners find their profit in trouble-free operation and completely automatic dependability.

If you know the Bryant Water Heater from experience, you're probably well acquainted with the many features which have made it famous. If you haven't had the opportunity to deal with Bryant before, now is a good time to investigate for yourself. Bryant will be happy to provide you with all the pertinent facts. Write Bryant Heater Division, Department 102, Affiliated Gas Equipment, Inc., 17825 St. Clair Avenue, Cleveland, Ohio.

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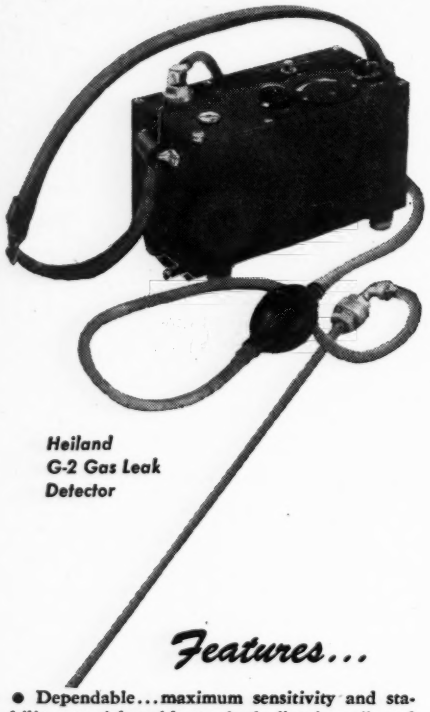

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Features...

● Dependable...maximum sensitivity and stability. ● Adaptable to both "aspirator" and "open flow" tests. ● Ruggedly constructed for above average abuse by maintenance crews. ● Lightweight...compact...complete. No separate batteries, meters, gas chambers or dilutors. ● Ability to detect low gas concentrations as well as locating larger leaks. ● Economical operation ...uses only standard flashlight batteries for power source. ● Easy access to all parts of instrument; readily inspected and cleaned. ● Sample may be quickly aspirated through instrument. ● No restrictions in sample path; any rate of aspirator pumping satisfactory. ● Double filters retard the introduction of dirt and dust into gas chamber, greatly prolonging life of filaments. ● Three screens for ample explosion check.

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At a second general assembly session, winners of the 1951 prize papers will be announced. The report of the committee for study of practical methods and introduction of the general chairman for 1953 will also be featured.

PUAA Minneapolis Meet

On May 8 and 9 the Public Utilities Advertising Assn. will hold its 31st annual meeting at the Hotel Radisson in Minneapolis. One of the first items on the agenda is a report from the association officers, to be followed by talks on "Utility-Manufacturer Cooperation" and "How to Deal With the Press."

Speakers include Richard D. Furber, Northern States Power Co.; J. O. Christiansen, University of Minnesota; George M. Gadsby, Utah Power & Light Co.; and Clarence Manion, University of Notre Dame.

Commercial Gas School

When the 1952 AGA Commercial Gas School gets under way at Chicago's Edgewater Beach hotel, May 5-9, students will hear a group of leading specialists in the field and will also view the latest commercial cooking equipment, since the National Restaurant Show will be held in Chicago during the same week. The five-day school, billed as a seminar on the utilization and sale of gas for volume cooking and other commercial operations, is presented for employees of gas companies, equipment manufacturers and dealers, and interested consumers.

The Liquefied Petroleum Gas Assn. annual convention and trade show at the Palmer House in Chicago May 12-14 will be the magnet for an expected 2500 delegates. Sen. Richard M. Nixon of California will speak at the opening luncheon, and other speakers will include Richard P. Walsh, PAD; Harry J. Holbrook, NPA; and Arthur H. Motley, Parade Publication Inc., New York. LPGA's six industry sections will hold separate meetings on the final day.

Next Month

Research, Utilization Meet

Expert technicians will address the 1952 AGA Domestic Research and Utilization Conference at the Hotel Statler, Cleveland, June 5-6. Among the subjects to be reviewed are corrosion characteristics of materials used in heating equipment manufacturing, multistory venting, safety practices in service work, and combustion characteristics of fuel gases. Leon Ourusoff, Washington Gas Light Co., is chairman of the program committee.

At the June 23-24 New York-New Jersey Regional Gas Sales Conference, sponsored by AGA's residential gas section, 200 utility and appliance representatives will be brought up to date on automatic gas cooking, the gas laundry dryer as a load builder, future of gas refrigeration, new water heater selling techniques, and national advertising plans. The conference will be held at the Monmouth hotel, Spring Lake, N.J.

CALENDAR

MAY

AGA Commercial Gas School—Edgewater Beach hotel, Chicago, May 5-9.

National Restaurant Exposition — Navy Pier, Chicago, May 5-9.

Public Utilities Advertising Assn.—Hotel Radisson, Minneapolis, May 8-9.

AGA Natural Gas Department Spring Meeting—Biltmore hotel, Los Angeles, May 12-13.

Pennsylvania Gas Assn. — Wernersville, Pa., May 13-15.

Gas Appliance Manufacturers Assn. Annual Meeting — The Broadmoor, Colorado Springs, May 21-23.

AGA Production and Chemical Conference —Hotel New Yorker, New York, May 26-28.

Missouri Assn. of Public Utilities Annual Convention—Missouri hotel, Jefferson City, May 27-28.

Southwestern Gas Measurement Short Course—University of Oklahoma, Norman, May 27-29.

Short Course in Gas Technology—Texas College of Arts & Industries, Kingsville, May 28-30.

JUNE

AGA Research and Utilization Conference —Hotel Statler, Cleveland, June 5-6.

Canadian Gas Assn.—Chateau Frontenac, Quebec City, Quebec, June 8-12.

National Fire Protection Assn. Annual Meeting—Hotel Statler, New York, June 9-13.

Michigan Gas Assn. Annual Meeting — Grand hotel, Mackinac Island, June 23-24.

New York-New Jersey Regional Gas Sales Conference—Monmouth hotel, Spring Lake, N. J., June 23-24.

National Retail Credit Assn. 38th International Consumer Credit Conference—Statler hotel, Washington, D. C., June 23-26.

SEPTEMBER

Pacific Coast Gas Assn. Annual Meeting —Ambassador hotel, Los Angeles, Sept. 3-5.

Wisconsin Utilities Assn. Management Conference—Museum of Science and Industry, Chicago, Sept. 7-9.

Mid-West Gas Assn. 29th Gas School and Conference—Hotel Sheldon-Munn and Iowa State College, Ames, Iowa, Sept. 11-12.

New Jersey Gas Assn. Annual Meeting—Monmouth hotel, Spring Lake, N. J., Sept. 12.

OCTOBER

Wisconsin Utilities Assn. Technical and Sales Sections Convention—Schroeder hotel, Milwaukee, Oct. 1-3.

Independent Natural Gas Assn. of America Annual Meeting — Fontenelle hotel, Omaha, Neb., Oct. 6.

Pacific Coast Regional Restaurant Convention and Exposition—Biltmore hotel, Los Angeles, Oct. 7-9.

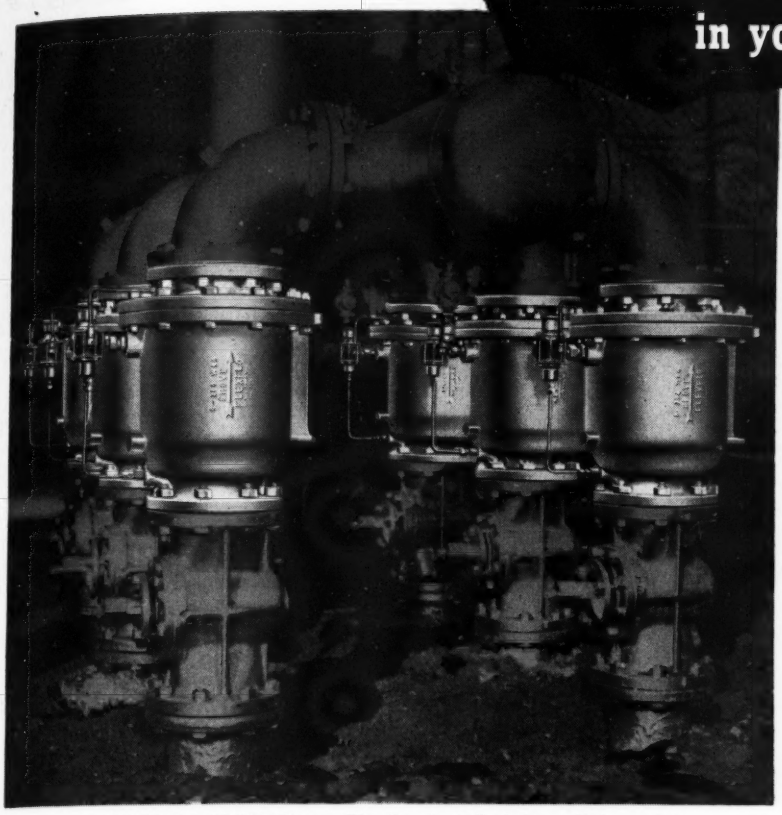
California Natural Gasoline Assn. Fall Meeting—Ambassador hotel, Los Angeles, Oct. 10-11.

American Gas Assn. Annual Convention—Atlantic City, N. J., Oct. 27-30.

NOVEMBER

American Petroleum Institute Annual Meeting—Chicago, Nov. 10-13.

IS SPACE A PROBLEM
in your regulator installations?



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Compactness, quiet operation and simplicity important advantages of expansible tube type regulator

For pressure reduction, back pressure or relief services, Grove Flexflo Regulators represent the ultimate in simple design and dependable operation. The Flexflo is basically a diaphragm operated valve. The only moving part is a flexible yet tough expansible tube, serving as *both* diaphragm and valve. Accurate control is provided by a wide variety of automatic Pilots, designed for specific requirements. Flexflos are instantly responsive to the slightest pressure variations. Shut-off is positive and bubble-tight. No stuffing boxes to leak or freeze. No metallic moving parts to corrode or stick. Action is smooth and frictionless with no damaging slam or chatter.

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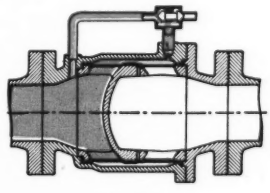
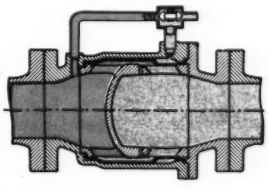


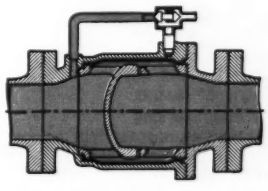
CLOSED

1 The only moving part in the Flexflo Valve is a tough Buna N tube stretched over a cylindrical slotted metal core. When closed, line pressure from within, tending to force tube off core, is opposed by equal jacket pressure. Tension of the tube itself forms a positive, bubble-tight seal. The tube conforms to uneven surfaces and is hence unaffected by foreign matter or erosive wear.



THROTTLING

2 As jacket pressure is reduced, line pressure begins to roll the tube off the core, opening the valve. Throttling is smooth and even. The Flexflo reacts instantly to the slightest pressure variations, compensating automatically for surge or shock impulses. Stability at all flow positions is accurately maintained. Fluttering and chattering are reduced to a minimum.



OPEN

3 When all jacket pressure is removed, the tube is forced completely off the core and the valve assumes its wide open position. Full flow capacity with minimum pressure drop is assured. As Flexflo employs no hinge-pins, guides or other metallic moving parts, no troublesome problems of corrosion or wear are encountered. It cannot stick, wedge or slam.

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Grove Flexflo Valves and Regulators are adaptable to air, gas, oil, water and other fluids at temperatures to 150° F. Available in iron or steel, sizes 1" to 12", for working pressures up to 1500 psi. Wire or write for full details.

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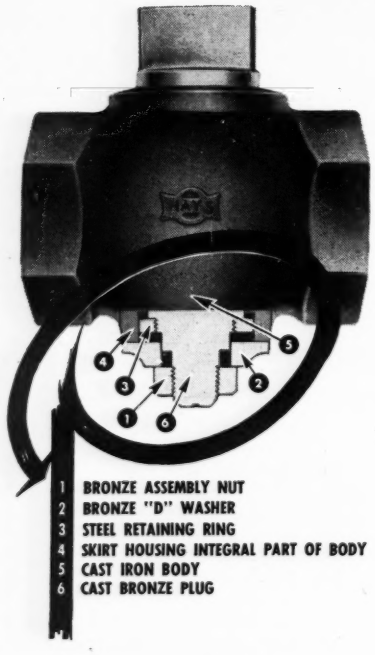

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6 CAST BRONZE PLUG

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ABSTRACTS

Excerpts from some of the talks delivered at the AGA Distribution, Motor Vehicles and Corrosion conference at Philadelphia, April 7-10.

Current Application of Metering Economics

Study of the application of principles of economics of metering must be made from time to time because of the varying character of underlying data over the years. Rising meter maintenance cost with age is considered by some to be in itself cause for meter obsolescence in the neighborhood of age 25 years, but an arithmetical analysis is given which shows that there must be a sharp rise in maintenance cost over ordinary levels at that time for this consideration to be true.

Loss in revenue, due to inaccuracy, is generally accepted as resulting from slow intest meters, but also may be due to fast intest meter policy of retroactive automatic refund on past consumers' billing. The retroactive period may have to be generous as a public relations matter, resulting, together with clerical expense, in a revenue loss.

Economic life of a meter in the Public Service Electric & Gas Co. appears to be 30 years. Large savings in metering expense can be made only on an extended periodic meter change basis. During the cycle of periodic meter changes occurring after conversion to a mixed gas, economic study favors the standard change period together with a fast meter intest refund (considered all revenue loss) over an accelerated change program.

—George K. Bachmann
Public Service Electric & Gas Co.
Newark, N.J.

Economics of Steel Service Pipe Protection

The investigation of the actual leakage history of several miles of service piping in the Gulf South area indicated that a possible reduction in the expenditures necessitated by underground corrosion would more than offset the cost of protection of these service lines.

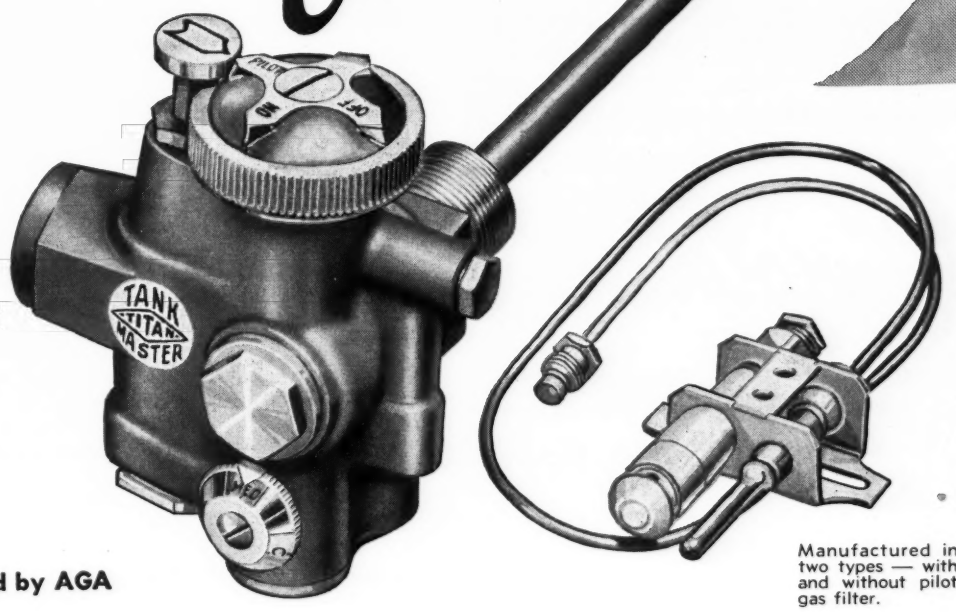
In addition to actually reducing the leakage expenditures during the normal expected life of the service lines, the useful life would be extended by the period of time that protection was maintained. The leakage data obtained from this piping were extended to determine the future leakage expenditures and the results compared with the results expected from complete protection of the service piping.

CORRECTION

William S. Tarver was erroneously referred to in "Thermally Thinking," GAS, March 1952, page 27, as "an assistant to FPC Commissioner Nelson L. Smith." Mr. Tarver was an assistant general counsel at the Federal Power Commission from July 1948 to April 1951.

Another reason why

Titan Tankmaster Excels!



Certified by AGA

Manufactured in two types — with and without pilot gas filter.

...factory adjusted valve REQUIRES NO FIELD SERVICE

These three features of the Valve, Valve Seat and Stem in the **TITAN TANKMASTER** assure constant, dependable operation —

The metal to metal valve and seat are precision machined and ground to assure sealing all gases. Designed to prevent sticking.

Since the clearance of the valve and mechanism are non-critical these parts are precision matched and the clearance is permanently fixed at the factory.

The thermal tube is taper threaded and solder sealed to the body to insure against water leaks.

You can depend on the action of the **TITAN TANKMASTER** mechanism to give true snap-action to the valve from full open to full close and visa versa.

Write For Full Information.

THE TITAN VALVE & MANUFACTURING COMPANY

9913 ELK AVENUE • CLEVELAND 8, OHIO

The economical factors are considered in a general nature and no attempt has been made to arrive at a final balance statement other than a comparison of the estimated expenditures necessary for the operation of the installed pipe versus cathodically protected pipe.

—Charles L. Woody
United Gas Corp.
Houston

Designs for Corrosion

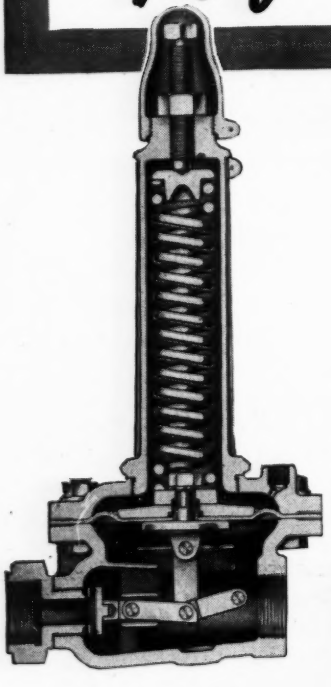
It is now possible to design for essentially corrosion-free systems. The most economical time to design for corrosion prevention is during the design of the basic installation being planned.

All operators are urged to keep these points fully in mind in the interests of economical operation. This does not mean that operators of large existing systems should not be concerned, for in order to keep abreast of developments in the corrosion prevention field, specifications for construction, operation, and maintenance should be carefully scrutinized at frequent intervals to be sure that the best known anti-corrosion practices are being followed.

Let us design against corrosion now—not later.

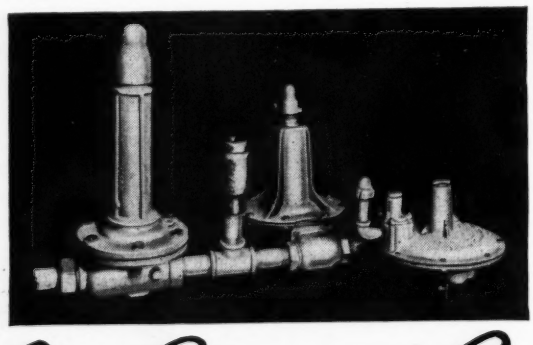
—A. W. Peabody
Ebasco Services Inc.
New York

IN THE HIGH PRESSURE FIELD
THERE IS SAFETY
IN Reynolds...



Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.



Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.
GAS CONTROL SINCE 1892

Analyzing Pipe Networks by Direct-Reading Electric Analogue Computor

The nonlinear electrical-analogy process of pipeline-network analysis is a convenient, simple, and rapid method of studying the performance of distribution or transmission networks.

Under ordinary circumstances, the first measurements made are the final ones. No trial-and-error steps are required. Results are indicated directly in fluid units, and only those values that are significant need be measured.

The process permits comparisons to be made quickly among various methods conceived for constructing or operating a pipeline network. It is especially useful for the distribution engineer who desires to achieve the best combination of economy and performance in operating a distribution system.

—Malcolm S. McIlroy
Cornell University
Ithaca, N.Y.

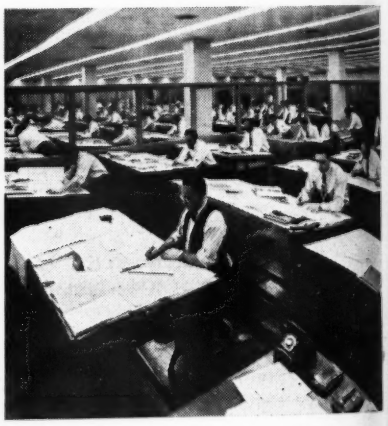
House Heater Servicing

In our case, experience has shown that a firm policy of requiring heating equipment of the best quality has been more than justified in promoting good customer and dealer relations because of longer lasting equipment, better service, and lower maintenance cost.

Advantages to our customers and the company due to the summer pilot program (keeping pilots lighted year round) primarily have been the result of carefully planned publicity and all departments of the company cooperating to the fullest extent and working toward the same end.

We believe that the optimum results will become a reality when the pilot input on new heaters coming on the line is reduced below the present level to 800 or 1000 Btu.

—C. S. Hazel
Philadelphia Gas Works Co.



PARTIAL VIEW of engineering department at new headquarters of Blaw Knox Co.'s chemical plants division in Pittsburgh. A larger engineering staff is quartered on another floor. The division acted as its own contractor in construction of the three-story building. Of functional design, it combines flexibility and economical maintenance with attractive contemporary styling.

NEWS

Financial

Lone Star Plans Systemwide Rate Hike

Most sweeping of a number of rate increases currently sought by utilities throughout the country is Lone Star Gas Co.'s announcement that it will raise residential and commercial rates in 375 towns in Texas and Oklahoma sometime this summer. About 600,000 customers would be affected. Rising taxes and costs were cited as the reasons for the change, which would be the first general revision in the Dallas company's rate structure since rates were reduced 13% in May 1942.

The California Public Utilities Commission has granted an annual boost of $4,890,000 on an interim basis to Southern California Gas Co., Los Angeles. The increase was allowed pending final ruling on the company's application for a permanent hike of $17 million yearly, on which hearings were resumed April 3. The interim increase took effect on April 10.

Southern Counties Gas Co., also of Los Angeles, last month appealed to the state supreme court to set aside a decision of the state commission denying the company a $3,390,000 increase which was applied for in March 1950. The commission denied the request in January 1952, the firm filed for a rehearing in February, and such rehearing was denied by the commission in March.

For the first time since 1941, Manufacturers Light & Heat Co., Pittsburgh, asked the Pennsylvania Public Utilities Commission to approve a boost in the price of natural supplied to large volume industrial consumers, to go into effect June 1. Another Pittsburgh utility, Equitable Gas Co., received notice that its proposed $3,022,000 annual increase had been suspended for six months by the commission. Public hearings were scheduled.

In the District of Columbia, the utilities commission has approved a new rate schedule for Washington Gas Light Co., amounting to $1,723,000 more a year, or 11%. It is the first upward revision granted the company since 1942. An April 23 hearing was set by the board of public utility commissioners in New Jersey on increases proposed by Elizabethtown Consolidated Gas Co., Elizabeth. The company's application contains a gas purchase adjustment clause which would increase rates if the present cost of natural gas delivered to the firm should rise.

Hope Natural Gas Co., Clarksburg, W. Va., appeared at a federal circuit court of appeals in Richmond, Va. last month to challenge a government rate-setting order concerning six wholesale customers. More than two years ago FPC suspended Hope's request for higher rates. Then, after a hearing, the commission ordered an upward revision. Hope claims the new rates were lower than those asked and the order made no allowance for the $750,000 the utility lost during the suspension period.

Recent FPC actions regarding rates included approval for United Gas Pipe Line Co., Shreveport, to withdraw its suspended schedule and to submit a new one; suspension of East Tennessee Natural Gas Co.'s (Knoxville, Tenn.) $431,000 increase, pending hearing May 5; postponement from April 22 to June 23 of a hearing on Panhandle Eastern Pipe Line Co.'s (Kansas City, Mo.) $21.4 million hike; and resumption of hearings on rates charged by Colorado Interstate Gas Co., which commission staff members have testified are too high.

El Paso Natural Gas Co. has announced plans to apply to FPC by July 1 for increases of about $17 million a year. Effective April 16, Consumers Gas Co., Toronto, raised its rates 25% for 170,000 customers. Transcontinental Gas Pipe Line Corp., Houston, is awaiting an FPC decision on its $13,654,000 rate hike on which hearings were recently conducted. Expansion plans depend upon the outcome.

Tulsa Company Purchased

Natural Gas Odorizing Co. Inc., Houston, has announced its affiliation with the American Research & Development Corp., Boston, as a wholly owned subsidiary. The move was made to strengthen the company's position in the field of research and development.

UNEXCELLED

MACHINED BRASS FORGINGS, CASTINGS, EXTRUSIONS to customer specifications...For defense production or essential civilian requirements

★★★★★★★★★★

Producers and Suppliers of materiel for: U. S. Army Ordnance • U. S. Navy • U. S. Army Air Corps • Maritime Commission and the following industries: Air Conditioning • Aircraft • Automotive • Beverage • Diesel Engine • Dry Cleaning • Farm Equipment • Gas Appliances • Locomotive • Oil Refining Equipment • Oil Heating Equipment • Plumbing • Refrigeration • Rubber • Spray Equipment • Washing Machine • and others.

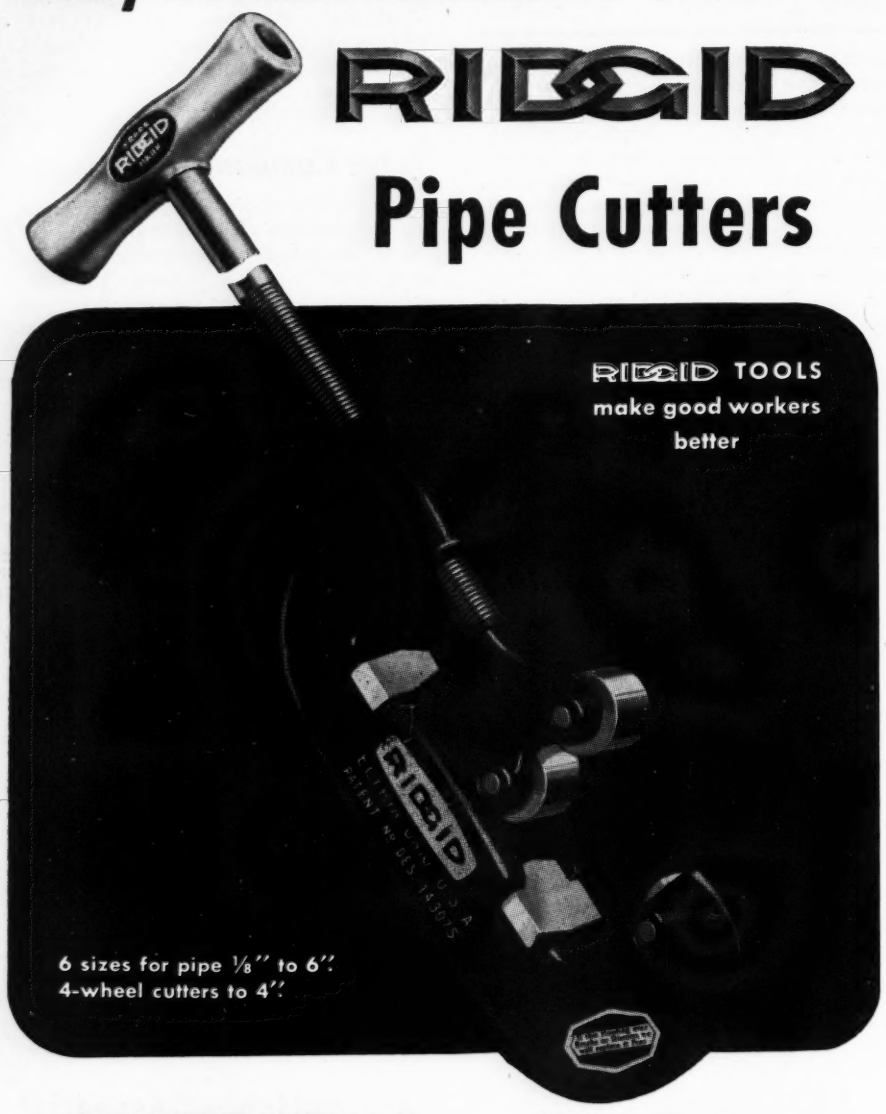
DETROIT BRASS & MALLEABLE WORKS

SPECIALTIES DIVISION

DETROIT 9, MICHIGAN

AT YOUR SERVICE IN THE NATIONAL EMERGENCY

Why Skilled Workmen Insist On RIDGID Pipe Cutters



RIDGID Heavy-Duty Cutters assure you extra quick easy pipe cutting

★ High alloy thin-blade cutter wheels roll quickly through pipe with least effort—clean, almost burrless cuts.

★ Special malleable housing guaranteed warp-proof, assures perfect tracking of cutter wheel—every tool factory tested.

★ Efficiency-balanced design for quick easy work—made for long hard service.

★ Order from your Supply House.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

No changes in personnel or management are contemplated, according to Charles E. Gill, president.

The company makes more than half of the natural and L.P. gas odorants used in the U.S. and also does business in Mexico, Italy, and France. In addition to its facilities in Houston, Natural Gas Odorizing has warehouses in Joliet, Ill. and Philadelphia.

Lone Star Acquires Wichita Falls Facilities

Lone Star Gas Co., Dallas, has received an FPC certificate of public convenience and necessity authorizing acquisition of facilities in the Wichita Falls District from Martin Wunderlich and Lee Aikin and construction of additional facilities to meet future market demands.

The facilities owned by Wunderlich and Aikin had been purchased from United Gas Pipe Line Co., Shreveport, and include approximately 678 miles of pipeline from Wheeler county to Young county, Texas, together with certain properties of United and Union Producing Co. in the Wichita Falls vicinity. Total cost of these facilities is $5,598,128.91.

Lone Star proposes to add 69.5 miles of 20-in. transmission line from Garvin county, Oklahoma, to its Petrolia compressor station in Clay county, Texas, and to construct gathering lines, miscellaneous well and field lines, and dehydration plants at a cost of $4,010,200.

Regulation

PAD Modifies Curbs on Heating, Industrial Gas

There was some easing of curbs on the use of gas for househeating and industry last month, but what actually happened fell considerably short of what a lot of gas consumers and prospective consumers had hoped for.

C. P. Rather, outgoing chief of the gas branch of the Petroleum Administration for Defense, started the ball rolling March 24 with a statement that improved supplies in the industrial northeast would bring some relaxation of controls. Following a meeting of the Gas Industry Advisory Council, he predicted that development of underground storage as well as completion of major lines to the Appalachian area would permit loosening of ceilings in the area.

Two weeks later, however, a special 10-man committee, selected for the purpose of helping PAD to decide on methods for removal of some of the restrictions, agreed that the curbs should remain, with only minor modifications.

Nonetheless, it appeared that some easement was still possible on a spot basis. On April 7, the industrial sales lid was lifted enough to permit Michigan Consolidated to serve three new defense industries — Michigan Steel Castings, Brooks & Perkins Inc., and the L.A. Young Spring & Wire Corp. Two other firms in the area were also permitted to add new gas-burning equipment on the basis that this move would not increase the two companies' use of gas.

In Kentucky, meanwhile, the state public service commission, which a week previous had certified to the President that it would take over control of gas supplies from PAD, dropped certain restrictions everywhere in the state except in the Louisville Gas & Electric Co. service territory. Gas furnaces may now be installed in new homes; and in commercial establishments, space heating equipment rated at no more than 400,000 Btu can be added.

Action on the Louisville case will await a decision by FPC in the pipeline application of LG&E's supplier, Texas Gas Transmission Corp., Owensboro.

In Ohio, Dayton Power & Light Co. was engrossed in hearings before the Ohio commission, which presently has a freeze in effect. The company estimated it could handle another 4900 new customers if the commission would permit it.

Noyes Succeeds Rather; Other Switches at PAD

H. B. Noyes

On April 1, Howard B. Noyes, vice president of Washington (D.C.) Gas Light Co., succeeded C. P. Rather as assistant deputy administrator of the Petroleum Administration for Defense. Mr. Rather has returned to his position as president of Southern Natural Gas Co., Birmingham.

Other recent changes at PAD include the appointment of Oscar W. Morton, Panhandle Eastern Pipe Line Co., to replace A. Dale Greene as director of the gas operations division. E. A. Koenig, Texas Eastern Transmission Corp., was named chief of the gas transmission branch in the same division.

New director of the gas planning division is Alan A. Cullman, Columbia Gas System Service Corp. He succeeded Walter E. Caine. G. Barrett Herr, Peoples Natural Gas Co., was named director of the gas facilities division, the post formerly held by Louis C. Sonnen.

Utilities Balk At Bills Proposed in Rhode Island

Utility officials in Rhode Island have voiced opposition to two bills which would expand state control over public utilities. Under the proposed legislation, utilities would stand the cost of state hearings on rates, and the state public utility administration would have the power of veto over plant expansion, the cost of which would be reflected in consumers' bills.

At a hearing before the house corporations committee, the utility representatives suggested that the state fix a dollar value on expansion projects requiring state approval and that the administrator give a decision on such projects without waiting 90 days after a hearing as provided in one of the bills.

The committee has not acted on the proposed legislation.

Look! It's Really Portable—

RIDGID

"400" POWER DRIVE

On Wheels!

Wheel legs and front handles available to convert your present "400" to wheel model; or legs and tray to make bench model into stand.

Power for hand threaders, cutters, reamers now easily rolled where you need it!

★ *One man* can easily wheel-barrow this popular RIDGID power unit close to the work—think of the time and muscle saving!

★ And it stands still and delivers plenty of power—universal motor, forward, reverse, ⅛" to 2"—to 12" with geared tools.

★ RIDGID design 3-jaw chuck, 6 adjusting pinions, one always handy; self-centering workholder in rear.

★ Sealed-in lubrication—no oil to spill.

★ See it, compare it—buy the unequalled "400" at your Supply House!

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools

Valve Industry Committee Makes Recommendations

The Steel Valve Industry Committee has recommended to the National Production Authority the simplification and standardization of valves, as well as longer lead times for procurement of necessary materials to produce steel valves and accelerate production for the defense program.

Stating that up to six months would be a reasonable lead time for the manufacture of bronze valves and up to nine months for steel valves, the committee reported that plants have sufficient capacity and manpower to meet defense orders and could even treble capacity if adequate lead time is given and sufficient materials made available.

Government officials generally concurred with the industry's standardization suggestion, with reservations where special problems justify special standards.

States Approve Control Over Pipeline Activity

Two states have enacted legislation giving state regulatory bodies control over certain phases of natural gas pipeline construction.

Final legislative approval was given to a bill which places natural gas pipelines under the jurisdiction, supervision, and regulation of the New Jersey Public Utilities Commission when the state senate concurred in a committee substitute for a bill previously voted by the assembly.

The bill permits the commission, after notice and public hearing, to promulgate reasonable rules and regulations for the safe construction, operation, and maintenance of natural gas pipelines, provided such rules are not inconsistent with provisions of the Natural Gas Act.

In determining the "reasonableness" of its rules, the regulatory body will consider, among other factors, the economic necessity and desirability of natural gas service and the effect of such rules on the cost of natural gas service.

In New York, Governor Dewey has approved a bill giving the public service commission jurisdiction over interstate natural gas pipelines insofar as their construction and operation affect the public safety.

Simultaneously, the governor vetoed five other pipeline bills which the public service commission said would be an unconstitutional restriction upon interstate commerce. The commission served notice, however, that its members felt the measures, with modifications, should be reconstructed next year.

Capacity Increase!

Added capacity at critical points can solve troublesome control problems — in gas, too!

Model RV-50 MAXITROL Gas Regulators in both ½" and ¾" pipe sizes now have an "extra" in the form of added capacity! Higher ratings were awarded by the AGA in December, 1951. The higher ratings appear for the first time in the January, 1952 issue of the AGA Directory. Old and new capacities are shown below:

		CAPACITY RATING (A.G.A. Listed)		
		Cu. Ft./Hr. at .3 Pressure Drop 0.6 Sp. Gr. Gas	Btu/Hr. Gases 800 Btu/Cu. Ft. or More (Natural Gas)	Btu/Hr. Gases Less Than 800 Btu/Cu. Ft. (Mfd. Gas)
FORMER RATING	RV-50—½"	252	186,500	126,000
	RV-50—¾"	253	187,200	126,500
PRESENT RATING	RV-50—½"	270	200,000	135,000
	RV-50—¾"	270	200,000	135,000

This "extra" capacity can cut your costs by reducing manifold components to ½" from ¾" pipe size . . . insure optimum performance under severe operating conditions.

DETROIT REGULATOR CO.
1742 RIVARD STREET DETROIT 7, MICHIGAN
Sold on the Pacific Coast by: PACIFIC SCIENTIFIC COMPANY
San Francisco, Los Angeles, Seattle, Portland

Miscellany

Service Firm Established At Bryn Mawr, Pa.

J. E. Brinkley

Organization of a service and promotion company to assist utilities with new construction in gas conversion, regulator installation, and distribution systems was recently announced. Located at 409 Fishers Rd., Bryn Mawr, Pa., the firm is General Gas Conversion Contractors. J. E. Brinkley is general manager, and other officers are A. C. Wilt, assistant manager; A. E. Barham, secretary and treasurer; and J. B. McManus, utilization engineer. The officials have been affiliated with utility and gas conversion companies and are veterans of conversion jobs totaling more than 1 million meters. The organization is a service company member of AGA and all the officers are also members.

General Gas Conversion Contractors is set up to assist with service contracts that cover appliance service, preventive maintenance, meter replacement, meter repair, sales and appliance surveys, and advertising and sales promotional campaigns.

Nuclear Research Lab Organized in New York

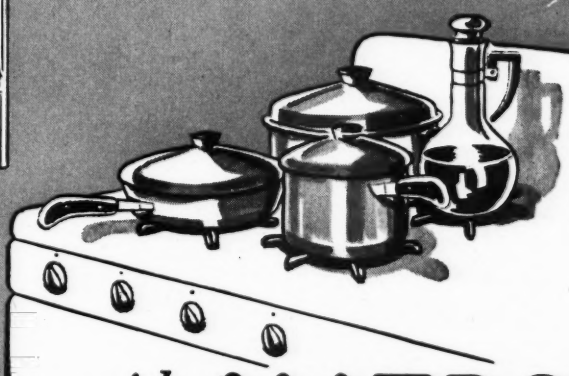
The first privately-financed laboratory for research in nuclear power has been organized as Walter Kidde Nuclear Laboratories Inc., in New York City. Its object is the development of atomic power for commercial use.

Services of the firm will be available to organizations interested in the design of nuclear power plants or in applications of nuclear technology to their products and processes.

Technical activities will be under executive

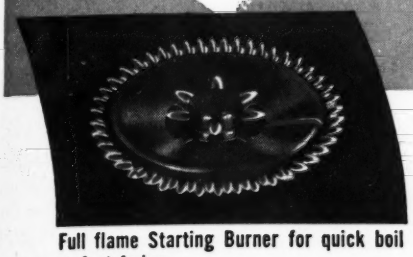
SELL WITH PROOF • NO. 3 OF A SERIES

demonstrate "KEEP-WARM" HEAT

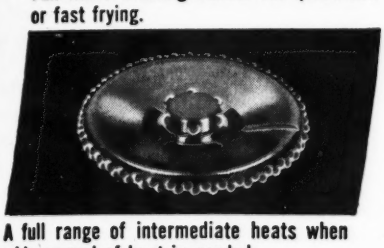


with ALLTROL® CENTER-SIMMER

and you sell the gas range!



Full flame Starting Burner for quick boil or fast frying.



A full range of intermediate heats when wide spread of heat is needed.

Click... here's efficient "Center Simmer" that maintains boiling in any covered vessel.

Click... a gentle "Keep Warm" heat... without further cooking.

Use These Tested and Proved Selling Points:

1. Tests prove that the ideal *keep-warm* temperature—keeping foods ready for serving without overcooking . . . or warmed-over taste—is 130° to 175° Fahrenheit.

2. Just a twist of the *Alltrol* control knob and the *Center Simmer* "clicks" into *keep-warm* heat range... keeps food just right for delayed meals ... late guests.

3. *Alltrol Center Simmer's* gentle *"Keep-Warm"* heat is flexible for dozens of other uses too... like melting chocolate, shortening, butter... thawing frozen foods.

Conclusion: ALLTROL CENTER SIMMER "KEEP-WARM" HOLDS FOODS AT IDEAL SERVING TEMPERATURE!

Write for names of gas ranges featuring the **"ALLTROL CENTER SIMMER"**

Send for this FREE Booklet "HOW TO SELL MORE GAS RANGES"
Address: Dept. 52G

ALLTROL® CENTER SIMMER

®*Trade Mark Reg. U. S. Pat. Office*

HARPER-WYMAN COMPANY

8562 VINCENNES AVENUE • CHICAGO 20, ILLINOIS

"Alltrol Center Simmer" Makes Gas the Winner

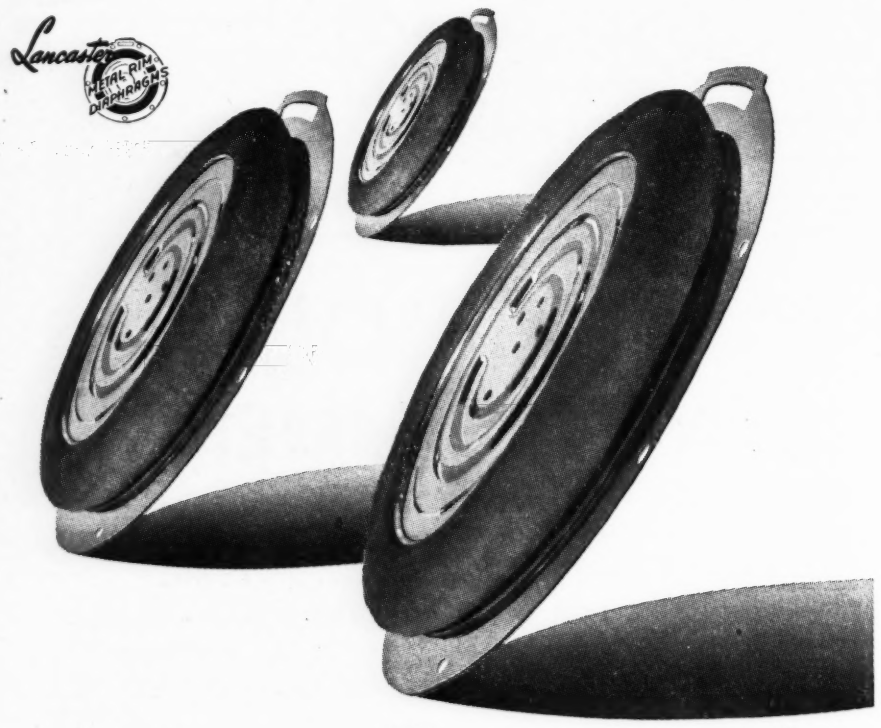
direction of Dr. Karl Cohen, former director of the Atomic Energy Division of the H. K. Ferguson Co. and a pioneer in early scientific work that led ultimately to the wartime Manhattan Project.

Two Brooklyn Utilities Receive Strike Threats

Brooklyn Union Gas Co. employees recently voted to accept a wage increase of $5 a week and other benefits and a threatened strike was thereby averted. The strike would have turned off the gas used for cooking and heating by a million families in Brooklyn and Queens. The employees are members of the Utility Division, Local 101, of the Transport Workers Union, CIO.

Kings County Lighting Co., also of Brooklyn, was threatened by strike when its employees, members of Local 291, Utility Workers of America (CIO), voted overwhelmingly to authorize such action.

The president of the company, Ephraim F. Jeffe, announced that the new union wage demands and a proposed increase in the cost of natural gas might force the company to ask for a 10% rate boost. The company had reduced its charges to customers last Dec. 1 by $102,000 yearly after the introduction of natural gas into its system.



Consistently Uniform Quality

Whether you install 2 or 2,000 Lancaster Metal Rim Diaphragms, you can be sure of consistently high quality performance in your meters. This is important for sustained meter accuracy and service . . . and it is another reason why so many meter shop men prefer to replace with Lancaster Metal Rim Diaphragms. Write for a sample and see why there is no substitute for Lancaster quality.

METER PARTS CO.

British Group Tours U.S. To Study Gas Industry

Sixteen representatives of British trade unions, management and technical groups, have been touring the United States to study the general setup of the American gas industry. The trip was sponsored by the Mutual Security Agency and the Anglo-American Council on Productivity.

Under MSA's productivity and technical assistance program, the group was scheduled to visit utility companies in a number of states and to visit the Bureau of Mines Experimental Unit at the Alabama Power Co. plant in Gorgas. They also attended the AGA conferences in Philadelphia and Cincinnati in mid-April.

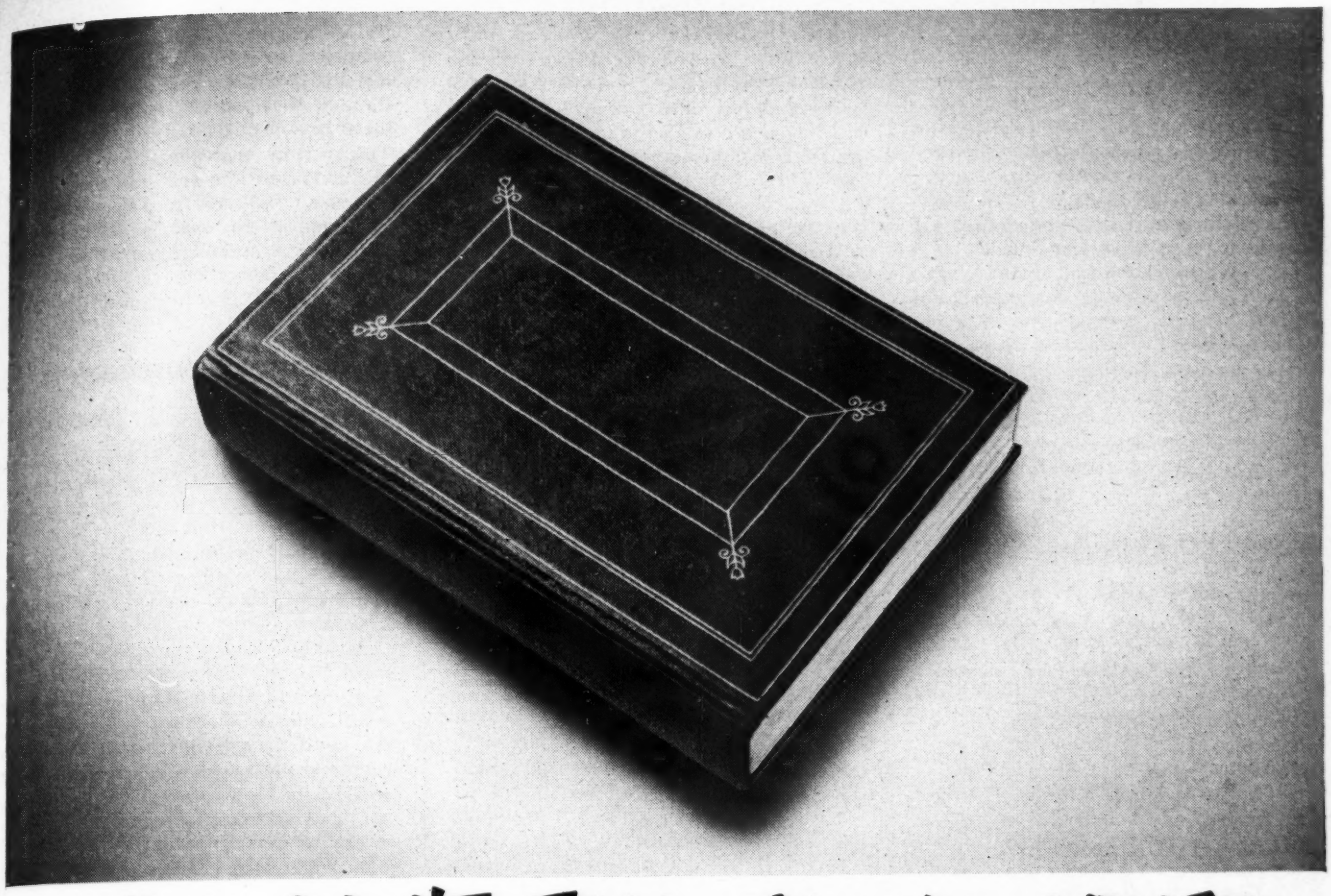
A major part of the group's study has been use of gas as a fuel in defense plants. Other subjects of interest include industrial relations, education and training, organization and administration, distribution technique, utilization of liquid and gaseous products of the distillation of petroleum, carbonization, tariffs, industrial and commercial applications, domestic installations and consumer service, and chemical processes for purification and recovery.

Safety Winners Honored

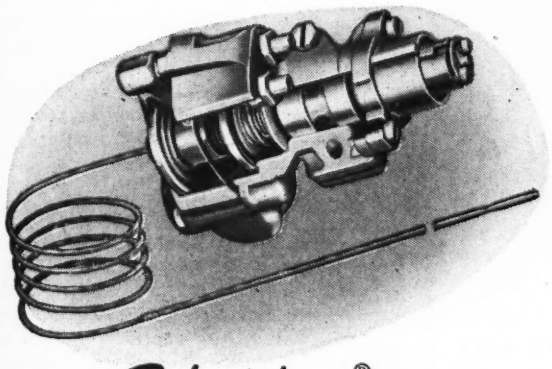
An honorary luncheon was held at the William Penn Hotel in Pittsburgh recently for divisions of the Peoples Natural Gas Co. which contributed most to the utility's 1951 safety record. The company earned first place recognition in a safety contest sponsored by the National Safety Council.

Safety Director Leo Nuhfer received the first place plaque at the dinner. Presentation was made by Christy Payne Jr., Peoples vice president. The divisions honored were Imperial and McKeesport compressor stations, Murrysville and Armstrong districts, Glenshaw City plant, and Forbes shop in Wilkinsburg.

GREAT BRITAIN'S gas productivity team examines Portland (Ore.) Gas & Coke Co.'s oil-gas and by-products operations. Shown, from left, are Joseph G. Chapman, Mutual Security Agency; C. H. Gueffroy, Portland president; John H. Dyde, Eastern Gas Board, London; Arthur C. Higgins, Institution of Gas Engineers, London; and Arthur Marsden, South Western Gas Board, Bristol.



YOU CAN'T TELL BY THE COVER



Robertshaw® MODEL BJ
Oven Heat Control

Straight line movement operates gas supply and temperature setting, increases accuracy and responsiveness, saves space, simplifies installation.

14 MILLION BEST SELLERS — that's the success story of the *Robertshaw* Model BJ Oven Heat Control, written in great measure by the nation's leading range manufacturers who last year alone bought 2,300,000 BJ Controls.

More "copies" are being sold today than ever before in our 51 uninterrupted years of manufacturing thermostats. Making 14 million units of a single type for a single purpose has given us an experience back-log unmatched in the industry. Continuous, extensive research and engineering progresses have resulted in many refinements and advantages that produce greater accuracy, dependability and durability.

Extensive advertising and promotion have made the *Robertshaw* trade-mark so well known that consumers ask for it by name, time and time again, wherever appliances are sold.

In Home and Industry, ***EVERYTHING'S UNDER CONTROL***

Robertshaw-Fulton

CONTROLS COMPANY • GREENSBURG, PENNSYLVANIA

Robertshaw Thermostat Division, Youngwood, Pennsylvania • Grayson Controls Division, Lynwood, California • Fulton Sylphon Division, Knoxville, Tennessee • American Thermometer Division, St. Louis, Missouri • Bridgeport Thermostat Division, Bridgeport, Connecticut

Conversion Work Started By Three Companies

Anticipating the arrival of natural gas, a number of companies are taking preliminary conversion steps. In Connecticut, Danbury & Bethel Gas & Electric Light Co. has completed installation of a hot oil fogger and a humidifier at its Pahquioque plant.

Long Island Lighting Co., Mineola, N.Y., has been authorized by the state public service commission to convert part of its system supplying 90,000 customers in Nassau and Suffolk counties. Adjustment of appliances will begin in June and is scheduled for completion in August. Estimated cost of the project is $1.8 million.

By May 15, Jersey Central Power & Light Co., Asbury Park, expects to complete initial preparations for straight natural, which is scheduled for introduction sometime this summer. Conversion crews are drilling burners for natural and adjusting them to burn with maximum efficiency the mixed gas now served.

Chicago Utility Scrapped 5 Million Pounds in '51

Public Service Co. of Northern Illinois, Chicago, sold nearly 5 million lb of scrap material last year as part of a continuing "house-cleaning" operation to help the nation's accelerated iron and steel manufacturing program.

The company coordinator of the scrap campaign is Art Senior, whose records indicate that from the end of World War II through 1951 more than 22,430,000 lb of metal have been discarded by the company. This includes approximately 14,260,000 lb of unprepared iron and steel and cast iron plus about 5,450,000 lb of aluminum, brass, lead, copper, tin, and zinc. Miscellaneous junk such as cardboard, mixed paper, electric meters, rubber, etc., accounted for more than 2,720,000 lb of the total.

Milwaukee Househeating Booms; More Gas Needed

At the end of 1951, Milwaukee (Wis.) Gas Light Co. had 51,786 househeating customers, 22,362 more than a year earlier, and the firm reports that 28% of its domestic customers are heating their homes with gas. Nearly one of every four homes in Milwaukee and its suburbs now uses gas for home heating.

Total customers at the end of 1951 aggregated 224,496, 7009 more than the previous year, the utility's annual report stated. President Dudley B. W. Brown warned, however, that until the government lifts restrictions on use of natural gas Milwaukee Gas Light will be unable to serve additional heating and large volume industrial users.

Natural gas sales last year were at a record high, 71% over 1950 and, in the heating category, 140% over 1950.

Ditching Record Claimed

Claiming the world's record for a one-unit ditch digger, George W. O'Connor, head of O'Connor Construction Co., Fromberg, Mont., reported that his crew had dug 17,200 ft of trench in a single day during construction of a gas pipeline from the Two-Dot gas wells to Warren, Mont.

The O'Connor company used a Cleveland Trencher ditcher powered by an International Harvester Co. UD-9 diesel engine.

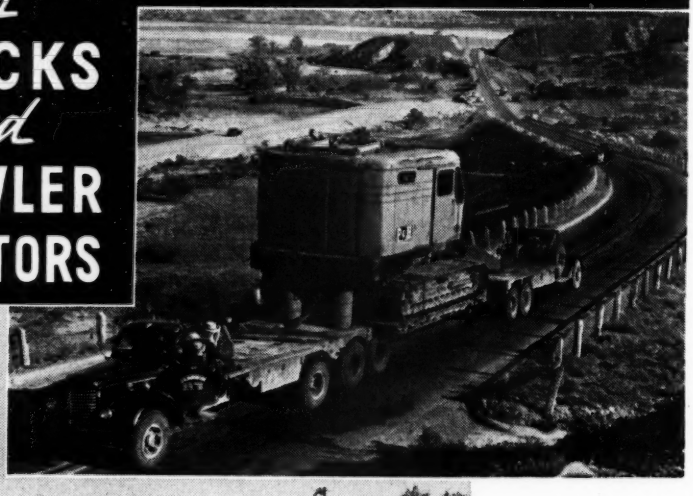
Miscellaneous

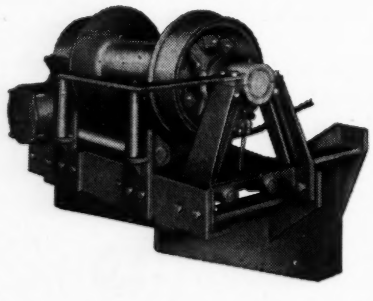
F. W. Dodge Corp., New York firm of construction and marketing specialists, reports that March construction contracts awarded totaled $1,321,254,000 or 49% more than during February and 4% more than March 1951. For the first three months of 1952, however, contracts let amounted to 10% less than during the same period last year.

Brooklyn (N.Y.) Union Gas Co. is seeking a substantial increase in the amount of natural gas currently available to it, according to the firm's annual report. Current estimates point to about a 40% load increase over the next few years, and the company plans to ask the FPC for an additional 40 MMcf daily.

Last month 100 workers at the Paterson, N.J. plant of Public Service Electric & Gas Co., Newark, went back to their jobs after a 13-day walkout. Members of the Independent Consolidated Gas Workers Union, they returned after agreeing to submit all grievances to arbitration.

PERFECT TEAM for TRUCKS and CRAWLER TRACTORS





There is a Tulsa* Winch for every make and model crawler tractor as well as all trucks. Tulsa Winch offers 28 different models, in capacities from 6,000 to 80,000 lbs., to fit every winching requirement. If you operate crawler tractors manufactured by **ALLIS CHALMERS, INTERNATIONAL HARVESTER, CATERPILLAR, CLETRAC,** or any other popular make, consult your nearest Tulsa Winch distributor or write direct to

THE WORLD'S LARGEST MANUFACTURER OF TRUCK POWER WINCHES

Tulsa Winch DIVISION OF VICKERS Inc.
TULSA, OKLAHOMA

*Reg. U. S. Pat. Off.

Manufacturer Points Out Lack of Central Heating

Only three out of five homeowners in the northern section of the country have central heating despite the fact that it is generally considered essential, Arnold Michelson, vice president, Minneapolis-Honeywell Regulator Co., told Pacific coast members of the Oil Heat Institute meeting in Seattle recently.

Mr. Michelson pointed out that in Washington alone some 540,000 homes need but do not have central heating. In Oregon, the figure is over 350,000 homes, he said.

He based his analysis of heating conditions on industry and government studies and a special nationwide survey made by his own company on the status of housing.

"All but obscured by the publicity given to the 5 million homes built since 1945," he said, "is the significant fact that more than 50% of our 45 million homes are 30 or more years old and beginning to lag behind in modern standards of living and comfort.

"Even in those homes having some kind of central heating a very small proportion of the equipment has been changed since installation back in the 1920's, despite the fact that government figures indicate that a boiler or furnace become obsolete in about 20 years."

New Plastic Pipe Available

Availability of a flexible plastic pipe for use in gas service lines and low pressure street mains has been announced by Carlon Products Corp., Cleveland, Ohio. Trade-named Carlon, it can also be used to reline corroded metallic systems.

Laboratory and field tests on pipe and couplings have indicated that Carlon will resist rot, rust, and electrolytic corrosion and will provide leakproof service in corrosive soils, waters, and fumes. It is said to be impervious to chemical attack and, because of its smooth internal surface, will not accumulate sediment.

Dresser Has New Division

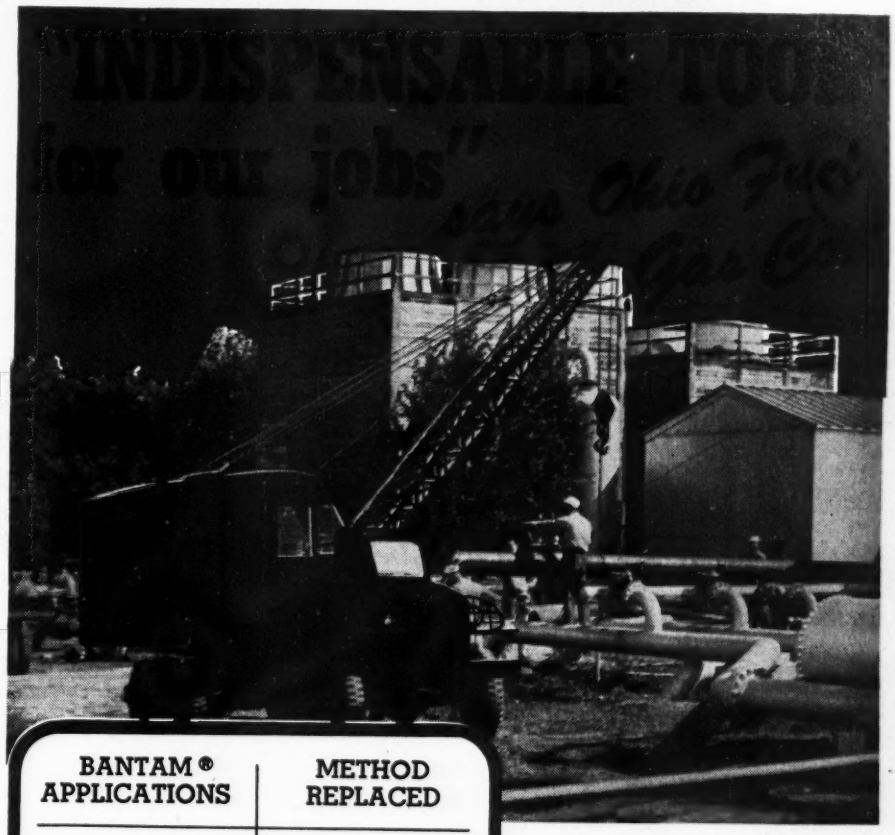
Roots-Connersville Blower Corp. has been absorbed into the corporate structure of its parent, Dresser Industries Inc., Dallas, and will operate under the name, Roots-Connersville Blower, a Division of Dresser Industries Inc.

Roots-Connersville will continue as a separate, completely integrated organization. Robert H. Owens has been appointed president of the division and Ralph Newquist executive vice president. No changes in organization or plant facilities as a result of the action are contemplated.

Servel Reduces Prices

Servel Inc., Evansville, Ind., has reduced prices on its galvanized-steel water heaters 4 to 10%, Emil P. Nensel, sales manager of the company's water heater division has announced.

The reductions, which go into effect im-



BANTAM® APPLICATIONS	METHOD REPLACED
Installing compressor units	Truck and high lift
Unloading pipe and materials	Contracted equipment
Aligning pipe and fittings	"A" frame, chain, falls, etc.
Excavating for leak repairs	2 to 3 men and truck
Uncovering short line sections	Trencher or hand digging
Lowering pipe into trench	Side-boom tractor, etc.
Back filling trench	Hand, dozer or slip board

NOTE: Bantam crane lifts 10,000 lbs. . . . works with 25' to 50' boom . . . quickly convertible to Back Hoe, Backfiller, etc.

Because of Schield Bantam's low price, big work capacity and high speed mobility — on or off highway— Ohio Fuel Gas Co. is *now using ten of these versatile truck-mounted machines,* with fast-change attachments, to reduce construction and maintenance costs. Why not investigate Bantam economy for your excavating and lifting jobs — today!

CLIP . . . MAIL TODAY!

SCHIELD BANTAM CO.
268 Park St. Waverly, Iowa

☐ Send details on truck-mounted BANTAM ☐ Crane ☐ Back Hoe

Name_____
Title_____
Company_____
Address_____
City_____ State_____

SB-CR-5

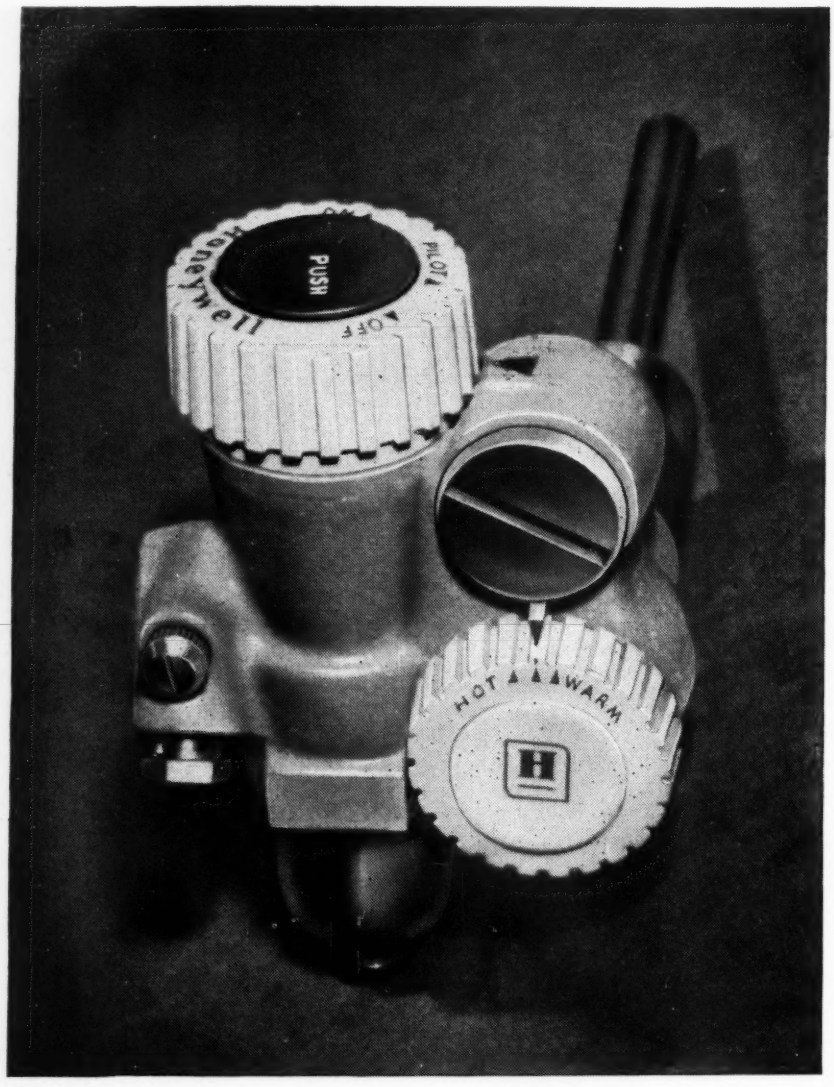
Look!

Includes 25' boom, 12" block, 2 part line and extra counterweight — less truck and mounting charge, F. O. B. Waverly, Ia. Price subject to change.

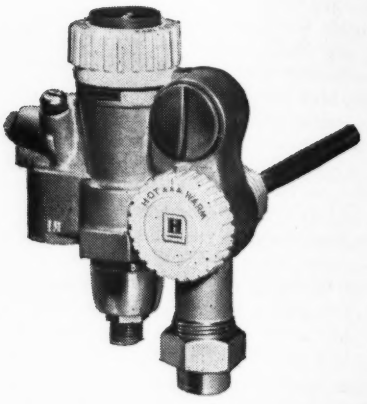
Bantam crane sells for less than **$5800**

Cranes • Excavators
Get more jobs done at lower cost

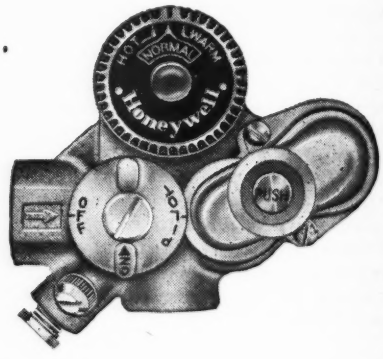
Another



The "20"—Model V-5120 is the star performer in this big new line of Honeywell water heater controls. It provides *complete 100% control* for natural, manufactured or LP gas! Main gas cock with pilot position, main burner pressure adjustment and the thermomagnetic pilot with 100% shut-off are all included in this compact control. Thoroughly tested at the factory to assure safe, efficient, trouble-free performance.



The "21"—Model V-5121 is a reasonably priced model in this great new line of Honeywell controls. It's primarily designed to take up minimum space so it can be used as a concealed water heater control. The "21" provides complete 100% control for natural, manufactured or LP gas—and includes the main gas cock with pilot position, main burner pressure adjustment and the thermomagnetic pilot with 100% shut-off in one compact unit.



The "19"—Model V-5119 combines rugged performance with attractive appearance! This fine thermostatic gas valve can be used for natural or manufactured gas. (Not suitable for LP gas.) It is sturdily built and carefully adjusted to give long, satisfactory service. Its compact design incorporates the following: snap-action thermostat; main gas cock with pilot position; integral pilot adjusting screw; main burner pressure adjustment; safe lighting thermomagnetic pilot.

Styled by Henry Dreyfuss

Here's a big extra sales feature of these new Honeywell-designed controls. The nationally known industrial designer, Henry Dreyfuss, helped Honeywell style these new controls for top sales appeal. The smart red and white control knobs match and blend ideally with the tank—giving Honeywell-equipped water heaters a more attractive appearance on your sales floor.

Honeywell First!

NEW GAS WATER HEATER CONTROLS DESIGNED AND BUILT BY HONEYWELL-STYLED BY DREYFUSS!

Here they are! A complete line of gas hot water heater controls—designed and built by Honeywell specialists—to give you the finest performing controls in the field!

They're compact! Check the new "flat" design feature of these Honeywell Controls! This makes installation easier and allows the control to be placed closer to the heater.

They're attractive! The eye-catching design of the new red and white control knobs on the "20" and "21" blends perfectly against the white tank background—adding sales appeal to your water heater line. The body of the "20" is painted attractive grey to further improve its appearance.

After-sale benefits are big! The compact, simple design makes Honeywell Controls easy to adjust. And precision manufacturing methods and exhaustive factory testing assure long, trouble-free performance, which will help reduce service calls!

Prospects know the name Honeywell means the best in controls—so why not insist on Honeywell-equipped gas hot water heaters and get this added sales feature!

Mail the coupon below and get all the sales facts about these new Honeywell-designed controls. Then you'll be able to take full advantage of the plus sales features they give you.

MINNEAPOLIS **Honeywell**

First in Controls

H HONEYWELL

Minneapolis-Honeywell Regulator Co.
Appliance Controls Division
8775 Mettler Street, Dept. GS-5-134
Los Angeles 3, California

Please send me detailed information on your complete line of gas hot water heater controls.

Name _____

Address _____

City _____ *Zone* ____ *State* _____

mediately, were made possible because of the greater availability of steel at lower prices. Water heater sales in January and February were ahead of the comparable 1951 months and a further pickup is anticipated during the spring months.

Eleven heater models, ranging in size from 20- to 45-gal., are affected by the price reductions. Prices on Servel's copper-ball heaters have not been reduced.

Sales and Promotion

New Sales Training Film Available From GAMA

A new sound-slide sales training film — "The Golden Stream" — designed to help plumber-dealers obtain additional sales dollars is now available from GAMA. Produced in Hollywood by Rocket Films Inc., the 20-min. film cost $12,000, according to Stanley C. Gorman, director of GAMA's water heating division.

For their own sales meetings, plumber-dealers may obtain prints of the film without cost through arrangement with their water heater manufacturers' representatives. Prints are obtainable for $50 from GAMA, but the film is not available on loan or rental.

Sales training methods are depicted through interviews with water heating experts. "The Golden Stream" will be shown at GAMA's annual meeting in Colorado Springs this month.

Michigan Firm Promotes Expanded Sales Forces

To stimulate dealers to build up local sales forces, Timken Silent Automatic Division, Jackson, Mich., has launched a "hire more salesmen" campaign which the firm believes to be unique in the automatic home heating industry.

Timken is offering to pay the cost of hiring, training, and outfitting the first 200 retail salesmen hired between March 20 and May 20. Each salesman hired under the plan will take a test to be written and scored by Stevens, Thurow & Associates, Chicago; attend a one-week training course at Jackson, during which time Timken will pay for his room and board; and receive a retail sales kit.

AGA Suggests Three New Public Relations Drives

Under the PAR plan, AGA's promotion bureau has issued an eight-page brochure titled "Three Ways to Achieve A Greater Gas Industry." Three timely campaigns designed to improve gas utility public relations and to promote year-round sales of gas are presented.

The first method suggested is to promote the sale of gas incinerators. Sales helps offered include "Gas Incineration Sales Maker," a training booklet, and "10 Short Cuts to Quick Cleanups," a consumer sales booklet.

Tell your story on househeating is the second recommendation. Different sales approaches are suggested for utilities operating under full restriction, partial restriction, or in areas where gas is plentiful. A sales maker is available, and a consumer booklet for direct mail and counter pickup has been prepared.

The third method, promotion of all-year gas air conditioning, is based on the slogan, "Provide a selling climate for a climate that sells." Air conditioning sales helps and "10 Ways to Take A Year-Round Vacation," a consumer booklet, are provided for participants.

3-Month Shipment Report

First-quarter shipments of gas-fired central heating equipment have been estimated at 111,000 units by the Gas Appliance Manufacturers Assn. This compared with 170,200 units shipped during the same period last year. Conversion burner shipments showed a slight increase over 1951, while furnace and boiler shipments declined.

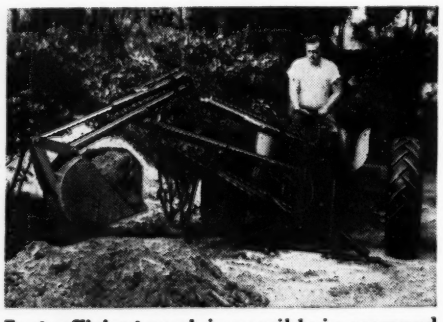
For the month of March, 11,200 conversion burners were moved, compared with 13,000 last March. March shipments of furnaces and boilers totaled 19,700 and 4000, compared with 1951's 41,200 and 7800 the same month.

DIGGING COSTS REDUCED!

The Sherman Power Digger has proved itself a champion cost-cutter on thousands of jobs where digging costs were formerly too high.

Wherever restrictions on weight and clearances make a job hard to get to, where rugged performance is a must, the Sherman Power Digger fills the bill on operations both large and small.

Back-hoe shovels retain their load up to 7 feet, to clear truck bed. The speed and efficiency of this popular digger is apparent once you see it at work.



Fast, efficient work is possible in cramped working areas. The Sherman Power Digger can even be used inside buildings. Only 7'6" overhead clearance is required.

Digs through asphalt and macadam—works well in hardpan clay, gravel, shale and stony ground. Easily operated with four simple hand controls.

• • •

Mounted on a rubber-tired Ford or Ferguson Tractor with Sherman auxiliary transmission providing 12 forward, 3 reverse and 3 power take-off speeds. Length only 15' 4"; height, 10' 3"; width, 5' 6". From one position will reach to dig 10 feet behind tractor in 140° arc and to depth of 8 feet.

For complete information and name of nearest distributor who can show you the money-saving Sherman Power Digger in action, WRITE TODAY to Sherman Products, Inc., Dept. G, 3200 W. Fourteen Mile Road, Royal Oak, Michigan.

Sherman PRODUCTS, INC.

Patent No. 2,303,825. Other patents pending

FARM AND INDUSTRIAL EQUIPMENT MANUFACTURERS

Designed, Engineered and Manufactured Jointly By SHERMAN PRODUCTS, INC., Royal Oak, Michigan • WAIN-ROY CORP., Hubbardston, Mass.

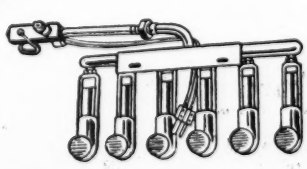
EXPERIENCE

SOLVES TODAY'S PROBLEMS FOR TOMORROW'S GAIN

EMPIRE *Gas* FLOOR FURNACES

FEATURING *The* FAMED

"Thriftmatic" *Gas* BURNER



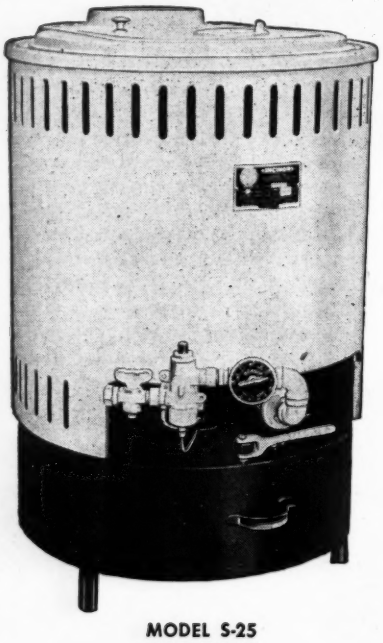
Empire's engineering experience, combined with dealer's customer servicing engineering, provides complete customer satisfaction.

See your local EMPIRE REPRESENTATIVE or write direct to

EMPIRE STOVE COMPANY
BELLEVILLE, ILLINOIS
WORLD'S LARGEST MANUFACTURER OF *Gas* FLOOR FURNACES

TO INSURE
CUSTOMER SATISFACTION
SELL...

AUTOMATIC Incinor
TRADE MARK REG U S PAT OFF
the gas-fired incinerator



MODEL S-25
AUTOMATIC
2-bu. capacity home unit

It's a "MUST" with automatic heat

Builders say, "it's just common sense to include Incinor — the modern way to dispose of wet or dry garbage and combustible trash."

Owners, by the thousands, say Incinor is indispensable—makes housekeeping easier.

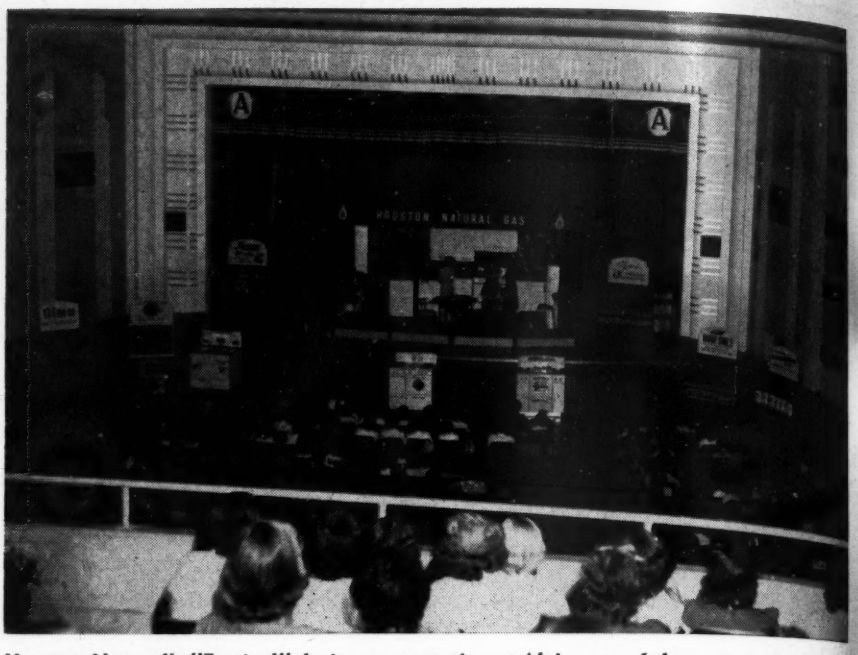
Incinor's attractive finish fits into basement or utility room—and it's easy to install—easy to operate. Setting the clock turns on gas which is automatically turned off at end of burning time.

A.G.A. APPROVED
Approved by A.G.A. for use with natural, manufactured or mixed gases, or liquefied petroleum gases.

4-bu. commercial units also available.

Write TODAY for catalog and price schedule!

INCINERATION DIVISION
BOWSER, INC.
Dept. C Cairo, Illinois



Houston Natural's "Festival" during presentation at Alvin, one of the communities served by the company.

Houston Natural's "Homemakers' Festival" Show Basis for Ambitious Dealer Assistance Program

By WILLIAM H. GRAY

THE show's the thing.

Dramatics, used nationally with the medium of radio or television, also can be used successfully as a sales promotion tool on a regional basis, in the form of a stage show placed on the road.

Houston Natural Gas Co. is establishing proof in its most ambitious dealer-assistance program in the company's 26-year history, a "Homemakers' Festival" road show that began its 1100-mile circuit March 11 and will have a three-month run with showings in 28 of the 80 communities in the company's 20-county territory.

"We are highly gratified with the public's acceptance of our show," reports Houston Natural's sales promotion manager, Rolland Storey, who personally packaged the show as producer-director. Mr. Storey, who studied speech and dramatics at Southern Methodist University, points out that all of the great stories of the world are told in dramatics, "so why not tell a commercial story dramatically, for best effect." Thus, he put together the "Festival."

A two-hour presentation that consists of a stage show, food show, and appliance show, the three-in-one "Festival" is the first of three separate, intensive, system-wide promotions designed to make gas appliances "easy to sell, profitable to sell, and easy to buy," says Storey.

The "Festival" ties in with the $750,000 national advertising campaign of the AGA and with the promotion efforts of leading gas appliance manufacturers. Mr. Storey pointed out, however, that the three-month tour of the "Festival" is strictly a home-area campaign, conceived and directed by Houston Natural and supported by it and by gas

Troupe of the "Homemakers' Festival," including Rolland Storey, producer-director, second from right; Kenneth Fellows, secretary and personnel manager of Houston Natural, third from right; and Winnell Simmons, home service director, extreme left.

Hamilton

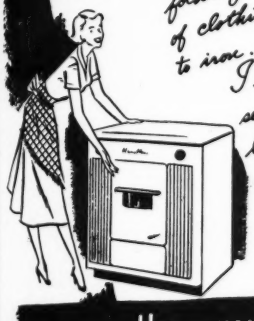
February 20, 1951

I could "wax poetic" about my Hamilton Dryer! Because of it, I feel I actually do not have a "wash-day" anymore.

The dryer is so simple to operate, so quiet while in operation, and the result is clothes that come out so soft and fluffy that I find myself folding and putting away many items of clothing I would otherwise have to iron.

I have no spring or fall housecleaning season any more because I can dry bedspreads, good-sized rugs, and curtains whenever the spirit moves me.

Mrs. Harold T. Hjermstad
4712 W. 41st Street
Minneapolis 16, Minnesota



FROM A Happy HAMILTON OWNER

FROM A Happy HAMILTON DEALER

BENDIX • TAPPAN • HAMILTON • SUNBEAM • APEX • WILSON

Minikada

4424 Excelsior Blvd., Minneapolis 16, Minnesota

February 20, 1951

The Hamilton Dryer franchise has done more to make the Laundry Sales Department of our store a success than any other unit. The Forster Distributing Company has been of the utmost help with many local sales promotions, advertising aids, and their Home Service Department.

Bob Schuh, Appliance Manager
Minikada Hardware & Appliances
4424 Excelsior Boulevard
Minneapolis 16, Minnesota

FORSTER DISTRIBUTING CO.

Wholesale Only

Brings You the Leading Lines

1122 HARMON PLACE • MINNEAPOLIS 3
PHONE • LINCOLN 8807

February 22, 1951

The Hamilton Dryer franchise is one of the most valuable in the entire appliance field. Every owner of a Hamilton Clothes Dryer experiences a labor saving which cannot be experienced with any other appliance. Every owner becomes a booster, and we find that one Hamilton Dryer sale is invariably followed by two to five additional dryer sales in the same area within the next several months.

The Hamilton Automatic Clothes Dryer is one of the most service-free appliances any dealer can handle, which means he can always know that a Hamilton Dryer sale is a profit able sale.

Sincerely,

FORSTER DISTRIBUTING COMPANY

G. W. Forster

G. W. Forster

FROM A Happy HAMILTON DISTRIBUTOR

HAMILTON MANUFACTURING COMPANY • TWO RIVERS, WISCONSIN

appliance manufacturers and brand-name goods distributors who serve the Texas Gulf Coast area.

Houston Natural's promotion manager emphasizes that the show is geared to the special selling problems of the area, is designed to entertain housewives royally, provides them with lavish gifts, and gets the common-sense story of gas across to them by the most convincing sales "gimmick"—powerfully pointed demonstrations.

The gas company expects to spend $25,000 to $30,000 of its own funds on the show. Gas stove manufacturers are awarding automatic stoves—one at each performance; gas appliance dealers in the communities award gas appliance items and carry supporting tie-in advertising bolstering advertising carried by Houston Natural; and brand-name food distributors award baskets of food. A total of more than 8000 items of food will be distributed during the three-month run.

The show, completely scripted for a two-hour presentation, has three professional performers: Milton Wilson, who has the male lead, and Misses Ann Hills and Jeannette Clift. Mrs. Winnell Simmons, home economist and director of Houston Natural's home service department, directs the dramatized cooking demonstration, which is the key of the "Festival."

The show, "Our Family Has Fun," is a dramatized gas-appliance demonstration and shows a day in the life of an average family, which has just moved into a modern, all-gas house. During the show, breakfast, luncheon, and dinner are prepared on the stage.

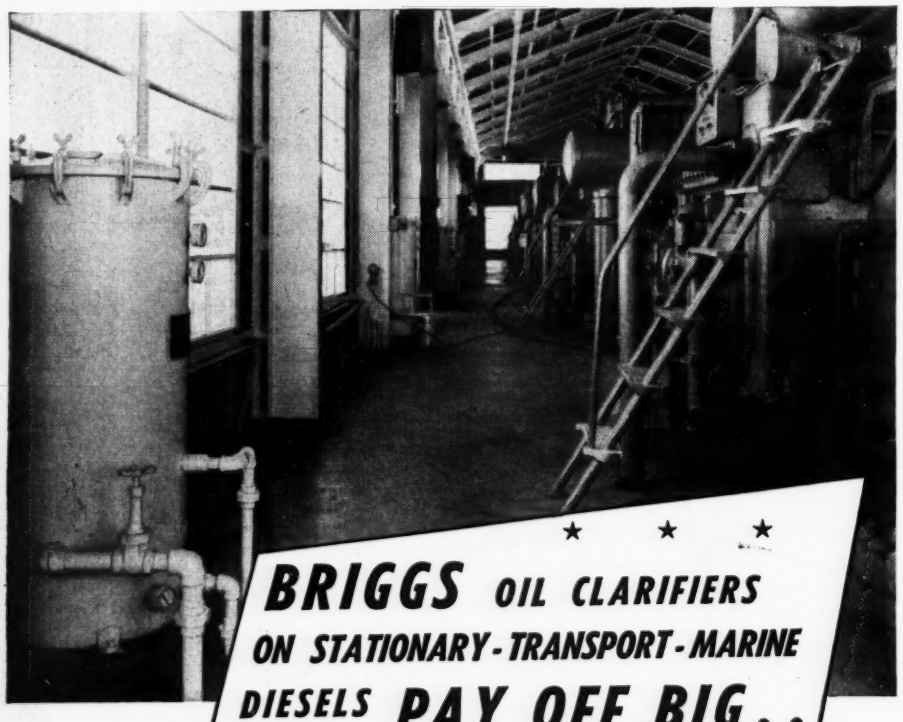
The show has two advance men, who contact dealers and handle other preparatory matters, and is completely self-sustaining, traveling in its own two 30-ft trailer trucks. The "Festival" carries a fully lighted, fully equipped portable stage, and has props, drops, sound equipment, and a complete kitchen set, including a sink unit with self-contained water facilities, a natural gas range, gas refrigerator, gas water heater, and flexible gas lines to bring fuel supply to the stage. A kitchen designed by Edith Ramsey, home equipment editor of the *American Home* Magazine, is used.

Attendance is averaging about one-third of the total meter count in small towns of 2000 and under, Mr. Storey reports, and is amounting to about 500 persons per showing in all communities. Forty per cent of the persons attending each show receive prizes.

About the only medium not thus far used in promoting the "Homemakers' Festival" is television. The company, through its advertising agency, is utilizing newspapers, radio, direct mail, window paste-ups, press-radio meetings, mat service, displays, posters, and other means.

The company is following up each show by compiling customer-prospect data gathered there and sending mimeographed reports back to each dealer, giving valuable information on prospects.

The "Homemakers' Festival" will be followed by three other campaigns: A series of community trade forums in key towns, a series of sales training courses for dealers and appliance sales people, and a "Harvest Home" promotion, featuring "a harvest of good living" in informal community meetings at night.



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BRIGGS OIL CLARIFIERS
ON STATIONARY-TRANSPORT-MARINE
DIESELS PAY OFF BIG..

...BECAUSE THEY KEEP
LUBE OIL CLEAN—PHYSICALLY AND CHEMICALLY!

100% BRIGGS IS PROOF!

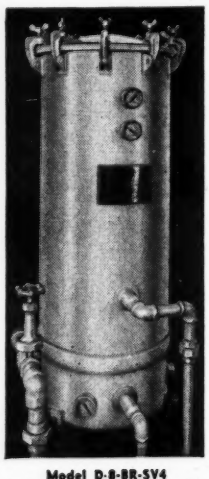
The Transcontinental Gas Pipe Line Station at Ellicott City, Maryland, is one of many installations 100% Briggs equipped. Yes, actually, wherever diesel or gas engines are used, operating men have proved over the years that Briggs Oil Clarifiers are superior—keep lube oil clean at less cost—engines run better.

BRIGGS HAS THE RIGHT FILTER
FOR EVERY DIESEL ENGINE

WOULD YOU LIKE TO HAVE YOUR PRESENT FILTERED OIL CHECKED?

Send us a sample and full engine data. We will put it through our laboratory and give you the report. If new filters are needed, we will recommend type and size.

★ A Briggs Catalog belongs in your file—write for one NOW!



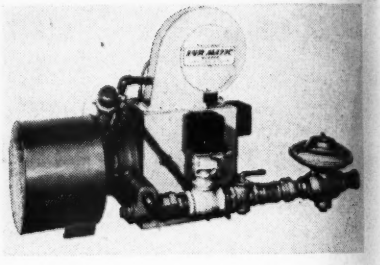
Model D-8-BR-SV4
One of seven Briggs Oil Clarifiers at Transcontinental in Ellicott City

Briggs
PIONEERS IN MODERN OIL FILTRATION

THE BRIGGS FILTRATION COMPANY
RIVER ROAD, WASHINGTON 16, D. C.

FOR MORE THAN A QUARTER CENTURY

NEW PRODUCTS



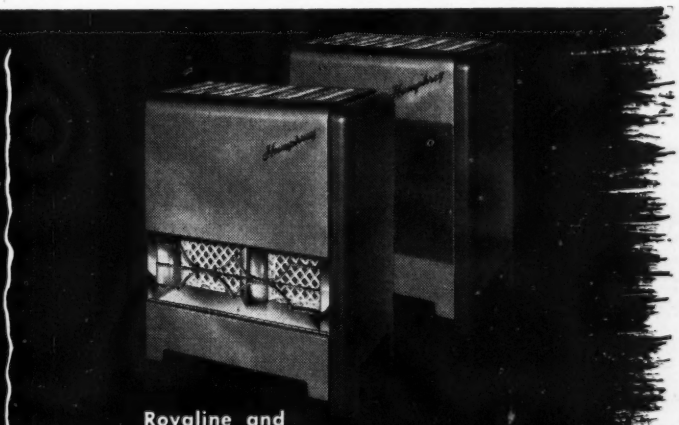
Combination Burner

A combination gas-oil burner designed for industrial and commercial use makes it possible to alternate fuels according to availability, economy, or suitability. Some of the possible applications for the new burner include steam boilers, water heaters, air heaters, heating plants, industrial ovens and bake ovens.

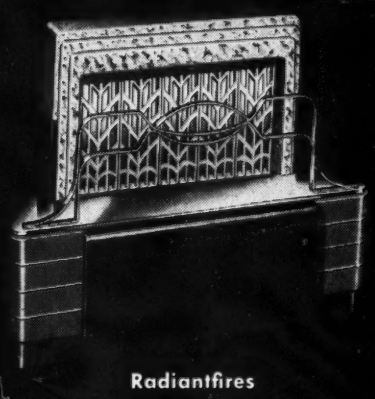
Features of the new burner, according to the manufacturer, include an automatic snap-switch for changeover, dual atomization, rotary flame action, simplicity of installation with all internal wiring and piping supplied, compact space-saving design with adjustable burner support, and instantaneous electronic

You'll be proud to display and sell Humphrey GAS HEATING EQUIPMENT

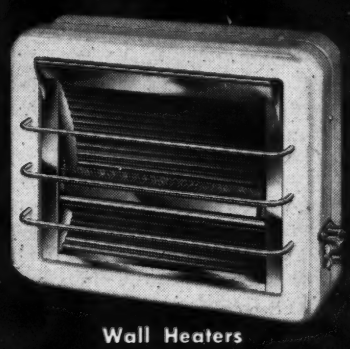
Automatic Gas Unit Heaters



Royaline and
Radiantfire Circulators



Radiantfires



Wall Heaters

HUMPHREY products are the kind that every retailer likes to display. Their top-notch styling and exceptionally handsome finish are immensely valuable selling features. They lend distinction to over-all store appearance and enhance retailer's reputation for carrying quality merchandise.

Humphrey Gas-Heating Equipment wears well, too. Your customers will like the staunchly dependable service they get from a Humphrey, and they will appreciate your recommending this kind of equipment to them.

The Humphrey line is a valuable one for any store. Year after year, it sells well, pays a good margin, and makes friends for the retailer. You can build yourself a good future, on lines like this. Why not get started with Humphrey now?

HUMPHREY PRODUCTS

GENERAL GAS LIGHT COMPANY

23 Warren St.
New York

KALAMAZOO, MICHIGAN

225 Eleventh St.
San Francisco

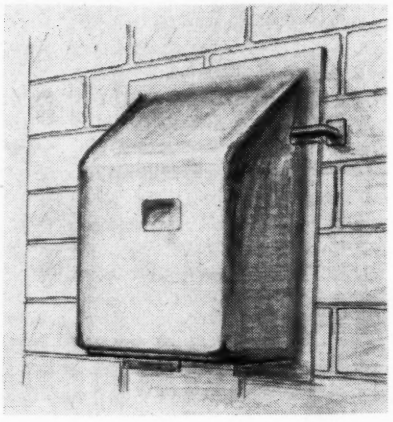
flame failure control assuring positive safety whether gas or oil is used.

The unit is a self-contained complete package.

Models: Fyr-Matic.
Eclipse Fuel Engineering Co., Rockford, Ill.

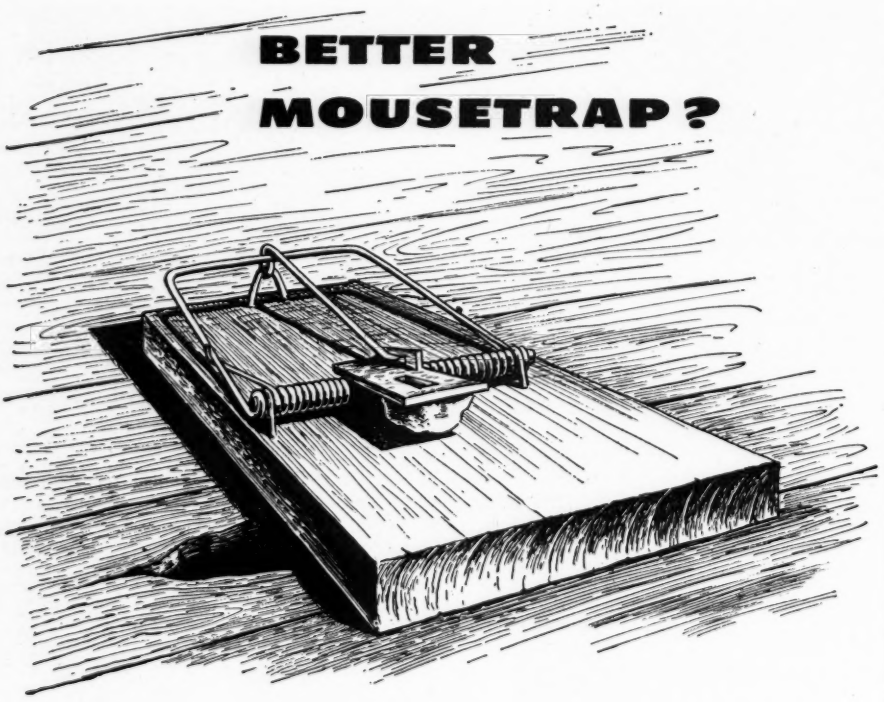
Gas Meter Cover

A meter cover has been developed for attachment to the side walls of residences or other buildings in localities where installation of gas meters and regulators on the ground is inadvisable because of climatic conditions.



The cover is made of Zenaloy, a material composed of glass fibers and polyester resins, and it combines an attractive appearance with strength and lightness of weight. The cover protects against freeze-ups and deterioration and may be stacked for shipment and storage.

Model: Gas meter cover.
Gordon Z. Greene Co., 2335 East 8th St., Los Angeles 21.



The story of the reward for a better mousetrap is proverbial. But the fact remains that most mice are still caught by this simple, economical and effective contraption.

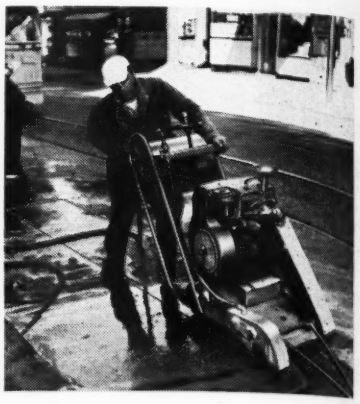
Gas purification is a parallel case.

Iron Sponge, preferred for the removal of H_2S seventy-five years ago, is still preferred today. And for these same reasons . . . simplicity, economy and effectiveness.

Iron Sponge operates with high efficiency at high or low pressures, has excellent capacity and activity, gives long service between foulings and is simply and quickly regenerated.

CONNELLY, Inc.

3154 S. California Ave., Chicago 8, Ill.
Elizabeth, N. J. • Los Angeles, Calif.



Concrete Saws

This line of concrete saws features diamond blades of three types of metal bonds—bronze, nickel, and steel. Each bond is available in several specifications designed for a particular hardness of aggregate and age of concrete.

Powered with either gasoline or electric motors of varied horsepower, the saws are chosen according to the volume of sawing to be done. A 13.5-hp engine powers the heavy duty Model C-130 which is particularly adapted to pipeline construction and street opening work. There are five models from which to choose, each designed for a specific job.

After a trench or patch is sawed through one-third of the slab depth, normal breakout takes place, leaving straight, smooth edges. The sawing procedure establishes a plane of weakness within the concrete or asphalt and thereby reduces the breakout time by as much as 50%, the manufacturer states.

Model: Clipper Cement Saws.
Clipper Manufacturing Co., Suite 646, 2800 Warwick, Kansas City 8, Mo.

Pipe Tape

According to the manufacturer, advantages of a new polyvinyl chloride pipe tape include its exceptional dielectric and insulation properties, its high adhesive firmness, extra strength, sunlight resistance, and excellent aging qualities. In addition, the manufacturer asserts, it provides effective protection against water, salt water, acids, alkalies, oil, and soil chemicals.

Because it conforms to irregular surfaces, it is adaptable for protection of service line fittings. It is applied cold and therefore may

Ever since you were knee-high to a hop-toad, you've heard about America's wonderful *natural resources*—the bountiful fertile fields, the towering timber growth, the boundless water power, and the untold wealth of gold, iron, oil, silver, coal and other natural treasures that lie buried in the ground.

Is it because America has *more* natural resources than any other country that Americans enjoy the world's highest standard of living? No—many countries have as much—some have more.

Then is it because Americans *do* more with what they've got?

Yes! And the reason is as plain as the nose on your face. It's because Americans are free to develop their natural resources—and their natural resourcefulness—in the wholesome climate of *open and strenuous COMPETITION.*

COMPETITION—not "regimentation"—is what eggs a man on to do his best.

COMPETITION—not government control—is what urges a business to give its customers ever greater value for their money.

So let's say "NO SALE" to the *ism* peddlers who would have us swap our U. S. A. system of free competition for their "planned" regimentation—trade our U. S. A. freedom and plenty for their serfdom and poverty!

* * *

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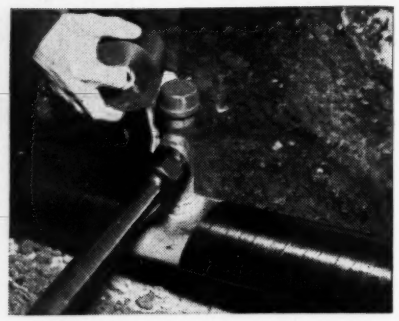
THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER



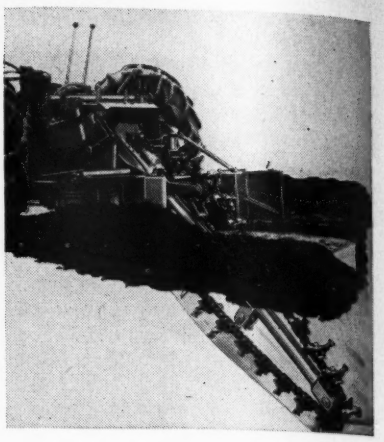
be safely used by workmen in cramped ditches. Backfilling can be done immediately as the tape requires no "setting-up" period.

Offered first in the 10 mil, 2 in. wide size, it will be supplied in a variety of sizes to meet complete pipe and pipe joint protection requirements.

Model: Dressertape.
Dresser Manufacturing Division, Bradford, Pa.

Trencher

A new Trench Hog may be equipped with booms 3½, 5½, or 7 ft in length for digging trenches of such depths. Standard or slicer cutters are recommended for ordinary

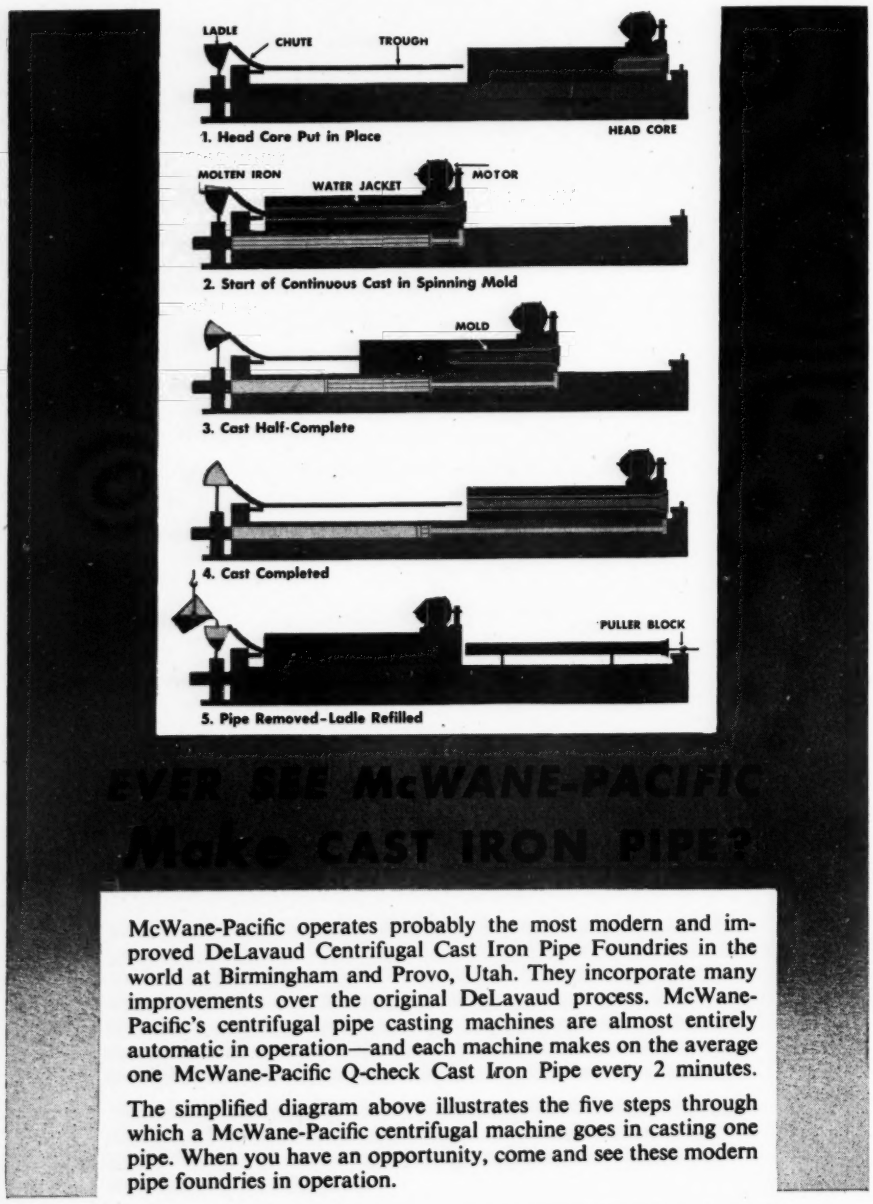


or sticky soils and are furnished in widths of 6 through 20 in. For digging extremely hard or rocky soils and frozen ground, super-service or disc cutters are used. They are supplied in widths of 7 through 18 in.

Optional features include a one-side dirt delivery attachment, a bulldozer for backfilling, heavy duty power sprocket for deep and wide trenches and a high speed sprocket which affords speeds up to 800 fph when digging narrow, shallow trenches.

The Trench Hog may be installed on Ford or Ferguson tractors, requires no special transmission, employs heavy duty 2-in. roller chain, and has anti-friction bearings at all critical points.

Model: Blackhawk Trench Hog.
Arps Corp., New Holstein, Wis.



EVER SEE McWANE-PACIFIC Make CAST IRON PIPE?

McWane-Pacific operates probably the most modern and improved DeLavaud Centrifugal Cast Iron Pipe Foundries in the world at Birmingham and Provo, Utah. They incorporate many improvements over the original DeLavaud process. McWane-Pacific's centrifugal pipe casting machines are almost entirely automatic in operation—and each machine makes on the average one McWane-Pacific Q-check Cast Iron Pipe every 2 minutes.

The simplified diagram above illustrates the five steps through which a McWane-Pacific centrifugal machine goes in casting one pipe. When you have an opportunity, come and see these modern pipe foundries in operation.

McWANE Cast Iron Pipe Company
Birmingham, Ala.
Pipe Sizes 2" thru 12"

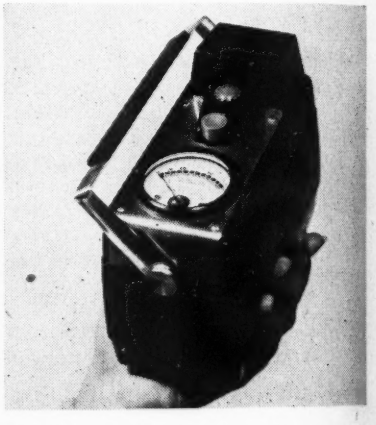
Sales Offices

Birmingham 2, Ala.....P. O. Box 2601
Chicago 1, Ill.....333 North Michigan Ave.
New York 4, N. Y.....80 Broad Street
Kansas City 6, Mo.....1006 Grand Avenue
Dallas, Texas.....1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

Provo, Utah.....P. O. Box 18
Denver 2, Colo.....1921 Blake Street
Los Angeles 48, Cal.....6399 Wilshire Blvd.
San Francisco 4, Cal.....235 Montgomery St.
Portland 4, Oreg...501 Portland Trust Bldg.
Salt Lake City.....Waterworks Equip't Co.



Odor Indicator

A small, portable instrument has been designed to measure odor thresholds and levels in fuel gases and is said to be equally effective with natural, manufactured, or L. P. gas. The meter will show the odor intensity within the lower limits of combustibility of any fuel gas anywhere within a distribution system, it is claimed.

Exact gas-air mixture at which the distinct odor is detectable is indicated on a delicately balanced gauge and is readable without reference to graphs, scales, or charts. A compact, one-unit device measuring 3 x 6 x 7 in. and weighing 54 oz., it can be carried by servicemen and used indoors or outdoors.

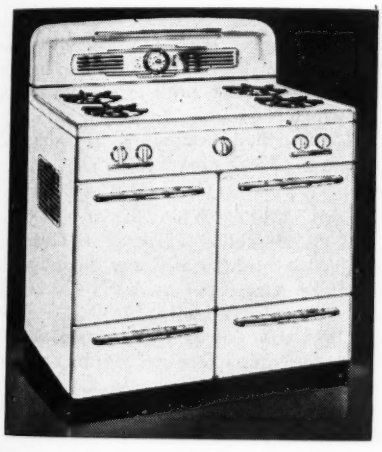
Model: Odicator.
United Petroleum Gas Co., 806 Andrus Bldg., Minneapolis 2.

Downflow Furnace

A new downflow gas-fired furnace for economical automatic heating of basementless houses may be installed in a kitchen or in an alcove and is designed for quiet operation. Rubber-mounted blowers give it the lowest possible level of blower or fan noise, and it uses ribbon burners which ignite quietly and go out quietly.

The furnace, which features a cast iron heat exchanger, is delivered as a complete package, factory assembled, wired, and tested. Three sizes are offered for use with natural, manufactured, or L.P. gas. The units are AGA approved and listed by Underwriters Laboratories.

Model: G-E downflow gas-fired furnace.
General Electric Co., Bloomfield, N. J.

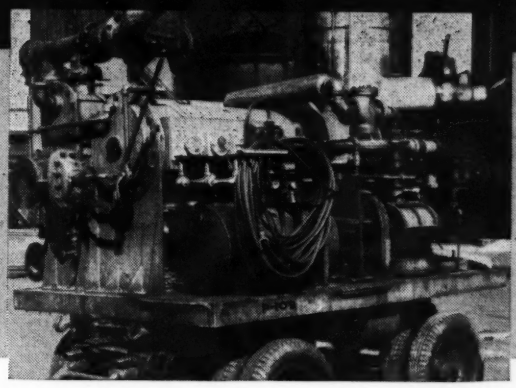


Kitchen-heater Range

A new kitchen-heater range for use with natural, manufactured, or L.P. gas features a divided top and backguard with lamp and timer. The kitchen heater in the left side of the range is powered by 35,000 Btu for natural, mixed, and L.P. gas, and 25,000 Btu for manufactured. The cooking section of this AGA-approved model has a balanced-heat oven, and a broiler with a high-speed, low temperature burner.

Model: 5526-1 KH.
Hardwick Stove Co., Cleveland, Tenn.

GUARD AGAINST EXPLOSION with R·C INERT GAS GENERATORS



Portable R-C Inert Gas Generator used for purging operations and stand-by protection in large gas-producing plant. Capacity 15,000 cfh.

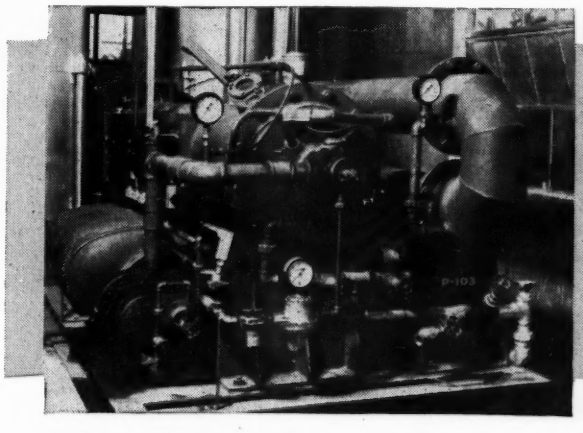
If your operations involve materials or processes which might cause an explosion-produced fire, you can reduce the risk with R-C Inert Gas Generators. In many instances, the relatively small cost is absorbed by savings in insurance costs.

These mobile or stationary units instantly produce a continuing flow of inert gas, for use in purging gas or liquid lines, blanketing dangerous areas and for many other industrial uses involving the handling or storage of explosive materials.

R-C Inert Gas Generators are compact, simple and inexpensive to operate, with either oil or gas as fuel. They are available in capacities from 1,000 cfh to 50,000 cfh, with characteristics to match specific requirements.

Where even a relatively low explosion hazard exists, one incident might produce a disastrous fire. Ask for details on how such dangers may be averted with R-C Inert Gas Generators.

ROOTS-CONNERSVILLE BLOWER CORPORATION
526 Oregon Avenue, Connersville, Indiana



Installation of three R-C Inert Gas Generators similar to this one helped one large plant save $6,000 per month insurance premiums, as well as substantially reduce danger of production losses caused by explosion or fires. Capacity of each unit, 6,000 cfh.

Reg. U. S. Pat. Off.

ROOTS-CONNERSVILLE
BLOWER BUILDERS R-C SINCE 1854
ONE OF THE DRESSER INDUSTRIES

You'll hear details soon from the **SERVEL** distributor.

NATURAL GAS ODORIZERS

(STATE APPROVED)

FOR

- Utilities
- Industries
- Communities
- Individual-Domestic

DETECTION IS PROTECTION

Avoid

Loss • Litigation

RELIABLE METER COMPANY

P. O. Box 4001 • Houston 14, Texas

CURRENT READING

TENTATIVE CODE COVERING INSTALLATION, PROVING AND OPERATION OF POSITIVE DISPLACEMENT METERS IN LIQUID HYDROCARBON SERVICE—The American Petroleum Institute's current revision of the work of the Subcommittee for Joint ASME-API Volunteer Research, identified as API Code No. 1101.

The code covers metering in pipeline service, on tank trucks, at loading racks, and at bulk plants. It also contains sections on meters in liquefied petroleum gas products service and in oil well production service, and includes charts and diagrams.

The revision is the product of more than ten years work by the joint ASME-API committee. More than five years were spent in preparing the 1946 edition and suggestions for improvement offered since that time have been inculcated in the new edition. The revision is believed to represent a solution of most of the problems which have arisen from actual use of the code. Copies may be obtained from J. A. McNally, American Petroleum Institute, 50 W. 50th St., New York 20, N. Y. Price: $2.

HEATING, VENTILATING, AND AIR CONDITIONING GUIDE—The 1952 edition of this comprehensive guide has just come off the press. It consists of a technical data section of 1064 pages of reference material on the design and specification of heating, ventilating, and air conditioning systems, based on the investigations of the research laboratories of the ASHVE and cooperating institutions and the practice of the members and friends of the society; also a manufacturers catalog data section of 431 pages containing essential and reliable information concerning modern equipment available for heating, ventilation, and air conditioning. This guide can be obtained at $7.50 per copy from the American Society of Heating and Ventilating Engineers, 62 Worth St., New York 13, N. Y.

A GAS-FIRED INFRARED DRIER TEXTILE SLASHING—Prepared by George J. Kyame as Information Letter No. 45. Published by American Gas Assn., 420 Lexington Ave., New York 17, N. Y.

The textile processing operation of slashing is the impregnation of textile yarns with a size. An important step in slashing is the subsequent drying of the sized warp. This drying operation was formerly done by steam-heated cylinders. Gas-fired hot air driers have also been used in recent years, however, and with the increasing availability of natural gas, the Department of Agriculture has undertaken to develop the drier described.

HOW TO SHOW YOUR NEW PRODUCT TO THE PRESS—Published by Gas Appliance Manufacturers Assn., 60 E. 42nd St., New York 17, N. Y. The GAMA public relations counsel has outlined pertinent "do's and don'ts" for press conferences in this brochure and has listed suggestions for insuring maximum coverage by newspapers, trade papers, and other media.

TRADE LITERATURE

WORTHINGTON PUMP & MACHINERY CORP., Harrison, N. J. — A recently issued bulletin announces a new LPG transfer unit to transfer volatile liquids such as butane and propane from tank car to storage tank. The unit also transfers the residual vapors which are left in the car after it is emptied of liquid and may represent 800 to 1200 gals.

The bulletin identified as H-609-B1, describes the unit and includes graphs of the residual vapor left in a 10,000-gal. tank car at different ambient temperatures. Specifications, schematic layout of the unit, and discussions of lubrication system, pressure gauges, suction surge drum, and base are included. Copies of the bulletin are available upon receipt of a request on company letterhead.

THE PYLE-NATIONAL CO., 1334 N. Kostner Ave., Chicago 51, Ill.—Now available are six new bulletins describing the company's line of high-efficiency impulse type steam, gas, or air turbines for mechanical drive, which has been expanded recently for general industrial use. Five of the bulletins are devoted to the types of turbines available, ranging from ¼ to 120 hp, giving performance charts, construction details, dimensions and weights, and selection data. The sixth bulletin provides general turbine information.

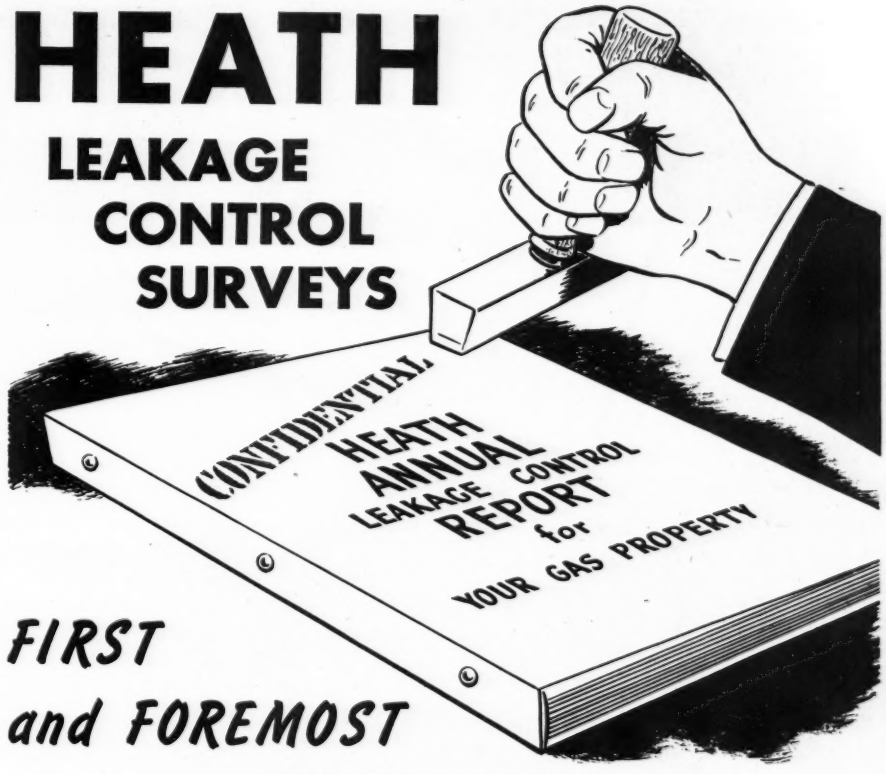
AMERICAN RADIATOR & STANDARD SANITARY CORP., Pittsburgh 30, Pa.—An engineering manual entitled "Remotaire Room Conditioner," pertaining to a unit for multiple installation, has been published recently. The system described is for office buildings, apartment houses, hotels, motels, hospitals, and residences and is connected to centrally located water heating and cooling plants. It offers individual control of temperature in every room without affecting adjoining spaces.

JOHNS-MANVILLE SALES CORP., 22 E. 40th St., New York 16, N. Y.—A four-page folder, TR-84A, on Transite flue pipe for venting domestic gas-burning appliances has been issued for insertion in the AGA "Reference Manual of Modern Gas Service." Also identified as AIA File No. 30-D-4, the revised folder replaces the former insert bearing the same numbers.

MAGNAFLUX CORP., 5900 Northwest Highway, Chicago 31, Ill. — Two folders published recently describe the company's job-by-job inspection services. Titled "Profit or Loss?", one of the folders describes Magnaflux laboratory inspection and the second, titled "Safety and Profit—Danger and Loss," pertains to field inspection service.

THE CLEVELAND TRENCHER CO., 20100 St. Clair Ave., Cleveland 17, Ohio—Complete specifications and dimension data on the Cleveland Model 80 backfiller-tamper-side crane are presented in a four-page bulletin now available. The one man-operated machine backfills as it tamps and travels.

HEATH
LEAKAGE CONTROL SURVEYS



FIRST and FOREMOST in YOUR **SAFETY** *PROGRAM!*

HEATH REPORTS show the location of your leaks . . . classify them for size and importance . . . enable you to reduce your leakage to a minimum and eliminate the potential hazard.

Milton W. Heath originated this modern type of survey 20 years ago and has developed it continuously ever since. Today Heath serves over 400 gas properties in 40 states and five Canadian provinces . . . renews its contracts year after year almost 100%.

For many years Heath has employed only graduate foresters and placed them in the field only after rigid training under its most experienced men. In fact, all important progress in present day survey techniques, training, classifications, and types of reports have been brought about by Heath employees.

Heath conducts all types of surveys in all sections of the country during all seasons of the year. Daily reports cover each leak location with proper classification. Heath surveys are *more* than vegetation and soil surveys — they are intensive, all-over leakage control surveys.

After each survey Heath gives you a bound loose-leaf volume containing the original copy of each leak report; plus special reports on cases involving possible claims where gas is not concerned; also on greenhouses, schools, churches and public buildings.

The fact that Heath is the only nationally recognized leak location agency lends authority to its reports and opinions.

Heath reports — *all confidential* — are highly rated by your insurance company and will stand up for use by your claims department . . . Heath Reports can save you thousands of dollars every year. Don't delay! Decide today on a Heath Survey!

You can't sell gas that leaked out!

HEATH
LEAKAGE CONTROL SURVEYS

Write, Wire, or Phone for Complete Information

HEATH TREE SERVICE, INC., 572 Washington St., Wellesley 81, Mass.

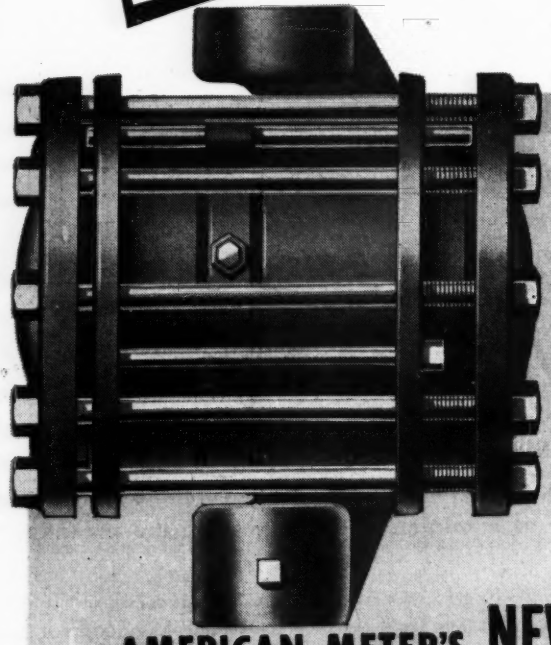
Midwestern Office — Richmond, Michigan

Another AMERICAN® Advance

THE NEW

A MERCURYLESS METAL

SUPPLEMENTING



AMERICAN METER'S NEW DIFFERENTIAL PRESSURE MEASUREMENT INSTRUMENT—

Adaptable to all American Pneumatic Controllers, Transmitters, Differential Valves, Telemeters and related instruments.

For differential pressure applications where accurate measurement is required without the use of a mercury manometer, American Meter Company now offers a bellows actuated instrument designed and built with characteristic American precision in ranges of 50", 100" and 200" for working pressures to 1,000 P.S.I. These new instruments are designed for ease of installation, accurate performance and minimum maintenance under rugged operating conditions.

• • •

Range changes are made easily and simply by removal of the low-side cover for access to the range spring without disturbing the high-side cover or any connections. Calibration, virtually tamper-proof since all adjustments are internal, is readily performed by applying the differential pressure on the high-side with low-side cover removed. Damage or distortion to the bellows due to sudden over-range is prevented by stick-proof check valves with flat, synthetic seats. An additional bellows compensates for volume changes in bellows filling fluid resulting from ambient temperature variations. The Teflon-sealed pulsation dampener, for accurate control of instrument response, is externally adjustable under pressure.

• • •

American is and will continue to be the first name in metering dependability. For complete information on this latest addition to the American line . . . built with the precision and extreme care characteristic of American Meter Company's century-old tradition of "Sustained Accuracy at Lowest Cost" . . .

Write for Specifications or Call the Nearest Office Listed Below

NO PRECISE LEVELLING — NO SEAL POTS REQUIRED
Pedestal, Panel or Overhead Hanger Mounting
— Top and Bottom Gage Line Connections

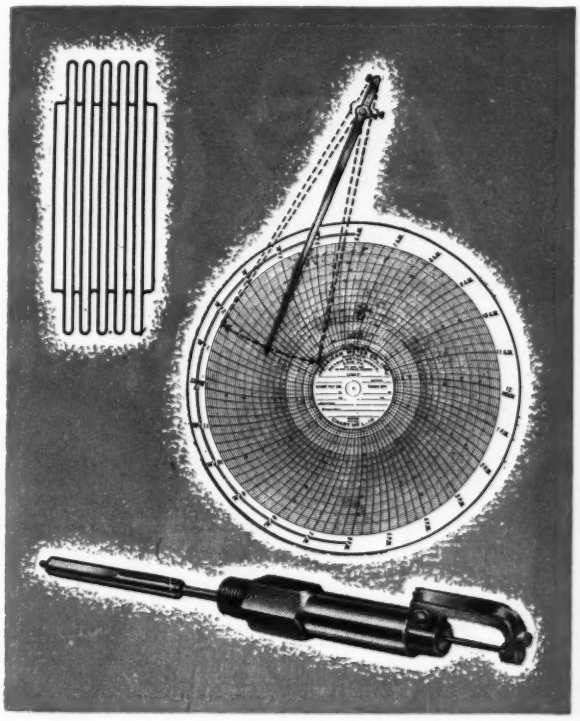
FOR WORKING PRESSURES TO 1,000 P.S.I.
... AMBIENT TEMPERATURES OF
—25° TO 175°F.

GENERAL SALES OFFICE: 1513 Race Street, Philadelphia
Albany • Alhambra • Atlanta • Baltimore • Birmingham • Boston • Chicago
Dallas • Denver • Erie • Houston • Kansas City • Los Angeles • Minneapolis
New York Odessa • Omaha • Pittsburgh • San Francisco • Tulsa
Canadian Meter Co., Ltd., Hamilton, Ontario • Edmonton, Alberta

DRI-FLO ORIFICE METER

BELLOWS DIFFERENTIAL PRESSURE INSTRUMENT

THE AMERICAN WESTCOTT MERCURY MANOMETER ORIFICE METERS



- **ONE-PIECE STAINLESS STEEL BELLOWS CONSTRUCTION**

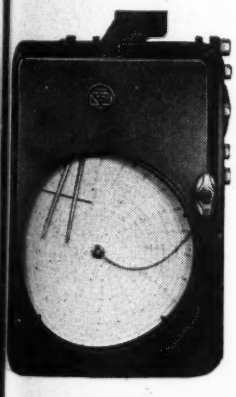
  Large area, fluid filled, *seamless* stainless steel bellows provide longer service life with minimum possibility of leaks caused by metal fatigue.

- **DIRECT FULL SCALE RECORDING PEN MOVEMENT— NO EXTERNAL GEARING OR LINKAGE MULTIPLICATION**

  Recording pen arm travels through the full 22½ degree arc without complex external gearing or linkage multiplication. Standard American Westcott charts are used.

- **AMERICAN TYPE "B" TEFLON SEAL STUFFING BOX NEEDS NO LUBRICATION**

  Noted for simplicity, this nearly frictionless precision unit provides maximum accuracy . . . *Requires No Lubrication.* All stuffing box parts are removable and replaceable in the field . . . *No Shaft Freezing; No Leakage.*



- **STAINLESS STEEL INTERNAL WORKING PARTS**

  All internal operating parts of the new DRI-FLO Orifice Meter are of stainless steel except the ground and polished stuffing box shaft which is Monel metal. Body is cast steel.

- **READILY ACCESSIBLE FOR CLEANING**

  The meter body and internal working parts are easily accessible for inspection, calibration and cleaning by removing one or both case cover heads . . . without disturbing manifold piping.

AMERICAN METER COMPANY
INCORPORATED [ESTABLISHED 1836]

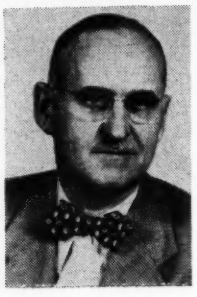
AMERICAN METER COMPANY
EST. 1836
MEASUREMENT ENGINEERS

PEOPLE

Rockwell Manufacturing Co., Pittsburgh, has announced a complete reorganization of its sales department involving the establishment of three Pacific Coast district offices to be located in Los Angeles, San Francisco, and Seattle.

H. BOEZINGER has been promoted to regional sales manager and will be succeeded as Los Angeles district sales manager by A. A. FOMILYANT, supervisor of Rockwell's Nordstrom Valve sales on the Pacific Coast. The Seattle district office will be headed by WILLIAM F. GULLEY, formerly a sales engineer in the Los Angeles and Seattle district offices. He replaces R. B. KITZMILLER who will head the San Francisco office.

A. A. Fomilyant



M. D. Gilbert

R. R. Bush

H. O. Proske

M. D. GILBERT has been promoted to Kansas City district sales manager and has been succeeded as Tulsa district sales manager by ROY R. BUSH. Mr. Bush was previously a member of the Tulsa sales staff but last year was appointed sales manager of oil field products with headquarters in Pittsburgh.

H. O. PROSKE, a sales engineer in the Kansas City area, has been appointed service manager for Rockwell and will have his headquarters in Pittsburgh. The position in Kansas City was filled by R. H. HEDGES.

JOHN E. SPEARS, control manager of the Gas and Coke Division of Koppers Co. Inc., Pittsburgh, since August 1949, has been named assistant general manager of that division. He will assist in the supervision of plants at Kearny, N. J., and St. Paul, Minn., which the division operates. Mr. Spears joined Koppers in 1929 as an accounting clerk.

C. COLGATE FISH has succeeded THOMAS P. VARLEY as purchasing agent of the New England Gas & Electric Assn. Mr. Varley has retired.

CHARLES A. ANDERSON has been appointed chief accountant of Peoples Natural Gas Co., Pittsburgh. He has been in Peoples' treasury department since 1937.

Manufacturers Light & Heat Co., Pittsburgh, has advanced four officers. C. A. MASSA, who has been with the firm since 1930, has been promoted from treasurer to vice president of Manufacturers and the Pittsburgh Group companies in the Columbia Gas System. Assistant vice president will be C. F. WATERMAN, formerly assistant

C. A. Massa

C. F. Waterman

treasurer, who joined the Columbia system in 1927. C. H. GOETZ has been elected treasurer of the company and affiliated companies, and K. M. REDINGER was named assistant treasurer. The two officers have been with the firm since 1924 and 1917, respectively. Mr.

ARCCO
BETA CHART PENS
...HOLD 2 to 4 TIMES MORE INK
Beta Fountain Pens hold two to four times the ink of ordinary chart inking pens. Regardless of the line thickness Beta Pens produce a smooth unbroken and uniform line. Pens shown are approximately actual size and can be arranged to reduce time interval between static and differential lines to only a few minutes. Beta Pens are especially suitable for seven day records. Price $1.10 (lower prices in quantities).
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Available for Early Delivery
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Two Strategically Located Plants

ON THE EAST COAST

Elizabeth, New Jersey

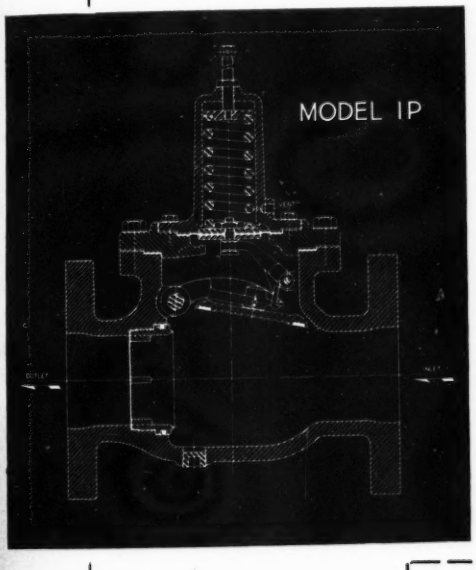
Lowell, Massachusetts

Portable Equipment For Operation At The Customer's Railhead Or Storage Site

Pipe Protection Service, Inc.

ELIZABETH, N. J.

10 Center Street — **ELizabeth 5-7440**



SECURITY

Automatic Shut-off Valves

MODEL IP (Increase in Pressure)

Security Valve will shut-off automatically when pressure increases to specified predetermined high . . . over normal line pressure. Closure pressure differential may be in inches or pounds for either high or low pressure application. Full range of sizes and classes from 1" through 8".

SECURITY VALVE CORP.

410 San Fernando Road • Los Angeles 31, Calif.

Send for further information

SECURITY VALVE CORP., P.O. Box 1551 ,Los Angeles 53, California

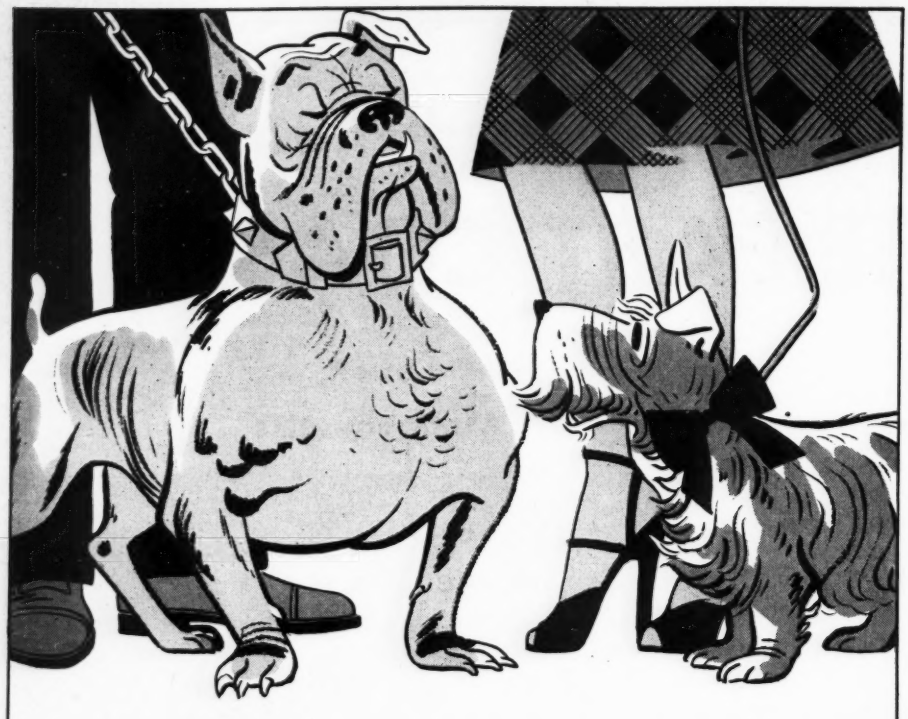
Gentlemen: Please rush me additional information on SECURITY AUTOMATIC SHUT-OFF VALVES.

Name and Title.....

Name of Company.....

Address.....

City.....**Zone**.....**State**.....



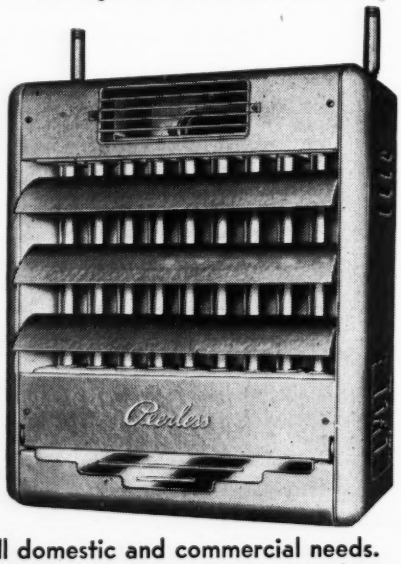
So your boss is that Servel guy with the
"BIG PROOF OF SUPERIORITY PROPOSITION!"

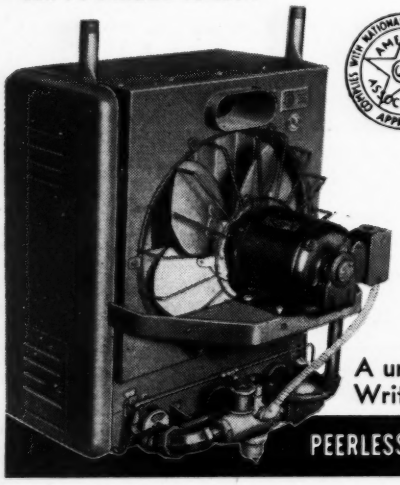
You'll hear details soon from the **SERVEL** distributor.

Best by every standard of expert comparison

GAS
Peerless UNIT HEATERS
best for you to sell . . . best for your trade to buy

A $ for $ comparison proves here's more for your money . . . plus saving in space and in installation time. A completely assembled ready-to-hang unit. Priced to sell . . . made to last.





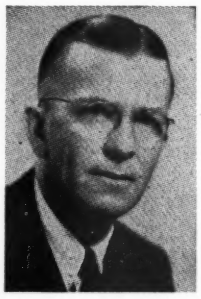
A unit for all domestic and commercial needs.
Write for complete details and prices today.

PEERLESS MANUFACTURING CORP., LOUISVILLE 10, KY.

Redinger was the chief accountant.

MILDRED NASER, home economist for Manufacturers, has succeeded MILLICENT BIBZA as home service director of the company's Hilltop office. DOROTHY STEWART, a Pittsburgh Group home economist, has been assigned to the Binghamton, N.Y. area.

A. T. CARROW has been appointed manager of sales by Cribben & Sexton Co., Chicago. He has been with the firm since 1929 except for an interval from 1947 to 1949 when he organized and developed the Blue Star Bottle Gas & Appliance Co. at Eau Claire, Wis. Since 1949, Mr. Carrow has been midwest division manager for Cribben & Sexton.



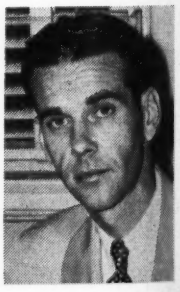
A. T. Carrow
Cribben & Sexton

A. H. Beach
Porter

H. K. Porter Co. Inc., Pittsburgh, has announced the appointment of ALBERT H. BEACH, assistant to the treasurer, as comptroller of the Hinderliter Tool Co. Division in Tulsa. Mr. Beach was formerly instructor of industrial management, cost, and budgetary control at the Robert Morris School of Business Administration, Pittsburgh. Mr. Beach was also a management consultant in New York, Philadelphia, and Chicago for some years.

Metropolitan Wire Goods Corp., New York, has announced the appointment of JOHN J. BOURKE as sales manager. Mr. Bourke is returning to civilian life after 17 months of active duty with the Air Force. From 1946 until his recall in 1950, he was director of commercial cooking promotion for the American Gas Assn.

New area superintendent for the Utica operating district of Niagara Mohawk Power Corp., Syracuse, N. Y., is JAMES E. COOPER.



M. P. Stillinger

Robertshaw-Fulton Controls Co., Youngwood, Pa., has announced two recent appointments. M. P. STILLINGER has been named sales engineer for the Grayson Controls Division, and WILLIAM E. BOWMAN has been assigned to the Youngwood plant where he will spend a year in training before going into the sales department. Mr. Stillinger was formerly associated with Day & Night Division, AGE, and with Southern California Gas Co., Los Angeles.

years of experience in one *Package*

complete L.P. gas plants
engineered - designed - installed

LP-GAS SPECIALISTS

H. Emerson Thomas and Associates, Inc.

P. O. BOX 270 • WESTFIELD, NEW JERSEY • WESTFIELD 2-2800

If you want the best — SPECIFY S.E.I.

S.E.I. Insulating bushings are made to these specifications:

1. Tightening torque 100 ft. lbs.
2. Bending resistance 200 ft. lbs.
3. All are pressure tested to 140 p.s.i. air for porosity.
4. Tensile strength over 4000 lbs.
5. Threads A S A pipe standards, tolerance only plus or minus ½ thread from gauge.

FOR ADDITIONAL INFORMATION PHONE . . . WIRE . . . WRITE

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Manufacturers of Industrial Plastic Products

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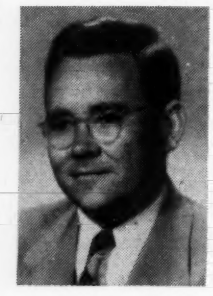
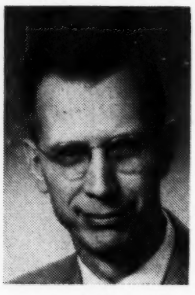
L. P. Thomas



W. F. Laird

W. D. Betsch



L. Longanbach

Three new officers have been elected in the Ohio Fuel Gas Co., Columbia Gas System's Columbus Group. They are W. F. LAIRD, secretary; W. D. BETSCH, assistant vice president, and L. H. LONGANBACH, assistant treasurer.

Mr. Laird has been resident attorney for the firm since July, 1951, and will continue in that capacity while secretary. He succeeds JOHN M. RUTHERFORD, former secretary who was elected treasurer in February and who has held the title of secretary-treasurer since that time.

Mr. Betsch has been assistant treasurer since March, 1950. He was named assistant to JAMES A. SCANLON, vice president in charge of rates and regulations. Mr. Longanbach has been supervisor of the statistical department and now will be assistant to Mr. Rutherford.

L. PROCTOR THOMAS, Houston, southwestern sales manager for the industrial chemicals division of the Mathieson Chemical Co. since 1949, has been elected a vice president of Houston Natural Gas Corp. He will be associated with the company's sales activities.

CHARLES P. DUNCAN JR. is now chief geologist of Manufacturers Light & Heat Co. and associated Pittsburgh Group companies in the Columbia Gas System. He succeeds FRANK A. BOYD who is now in business in Pittsburgh as a geologist and petroleum engineer. Mr. Duncan has been with the company since 1949 and has been assistant chief geologist for the past eight months.

Appointment of WILLIAM M. KREILING, Kansas City, Mo., as sales represeentative for the Mor-Sun Furnace Division, Morrison Steel Products Inc., Buffalo, has been announced. His territory will be Kansas and western Missouri. For the past seven years Mr. Kreiling has been a sales engineer in the Kansas City area.

ALLAN G. HALL has been named assistant engineer of distribution for Brooklyn (N. Y.) Union Gas Co. and has been succeeded as general superintendent of the Greenpoint Works by WILLIAM E. TATE. Both men have been associated with the utility for more than 20 years.

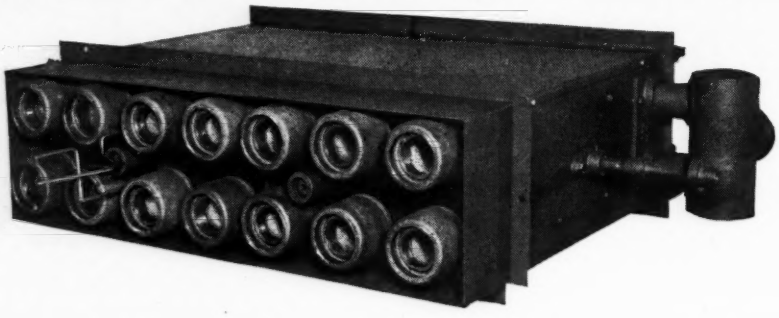
CLYDE W. ORGAN, former vice president and division manager of Central Illinois Light Co., Springfield, has been appointed to the Washington administrative staff of the National Production Authority, engine and turbine division. He has been with Central Illinois for 37 years.

H. P. GEORGE recently retired as manager of gas supply for Southern California Gas Co., Los Angeles. An active PCGA member for 32 years, he served as chairman of the association's technical section in 1942. S. A. BRADFIELD has succeeded Mr. George at SoCal.

S. H. BRICKER, who has been with Lone Star Gas Co., Dallas, since 1920, is retiring and will be succeeded as supervisor of the gas purchase and royalty section of the accounting department by H. G. RUNKEN. The latter has been with the company for almost 22 years.

LOUIS A. SCOFIELD, vice president in charge of Westchester operations, Consolidated Edison Co. of New York Inc., has been elected a trustee of Union Dime Savings Bank. Mr. Scofield has been associated with ConEd for 40 years.

WEBSTER KINETIC* BURNER



FOR LOW PRESSURE GAS

Scotch Marine type boilers, air heaters and any other type of "cold" furnace can be fired by natural gas at higher ratings.

The Webster Kinetic Burner is easy to install, compact and economical to operate.

It fires with extremely low pressure gas without noise, vibration or electric power and with minimum furnace draft.

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired.

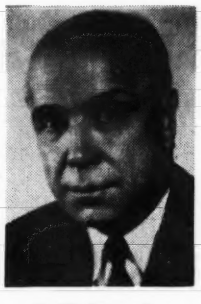
As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc. For complete information request Series B8 Bulletins.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

CHARLES A. HEATH, Richmond, Mich., has been named vice president in charge of operations and Midwestern division manager for Heath Tree Service Inc., Wellesley, Mass. STUART B. EYNON, Lynn, Mass., was appointed eastern division operation manager.

C. A. Heath
Heath Tree



P. T. Sharples
Philadelphia

At the recent annual meeting of Philadelphia Electric Co. stockholders, PHILIP T. SHARPLES was elected a director to fill the vacancy created by the retirement of HENRY B. BRYANS. Mr. Sharples is founder and board chairman of Sharples Corp., Philadelphia.

United Petroleum Gas Co., Minneapolis, which recently opened an office in Houston, has announced the employment of J. P. LYONS as assistant to the vice president, in charge of the Houston office. Mr. Lyons has had many years of experience in the petroleum and allied industries which will be of value in his new assignment. He was employed by Shell Oil Co. for 15 years and, since World War II, he has been associated with Bethlehem Steel Co. in Houston.

E. F. DAVIS, Chattanooga (Tenn.) Gas Co., was recently appointed general sales manager for the firm.

Appointment of RUSSELL W. MCINTOSH as corrosion products representative for the western and Pacific coast district has been announced by Dresser Manufacturing Division, Bradford, Pa. Mr. McIntosh has wide experience in the corrosion field, having been with Koppers Co. for 2½ years in the Tar Products Division and with Pittsburgh Coke & Chemical Co. as west coast manager of the Protective Coating Division.

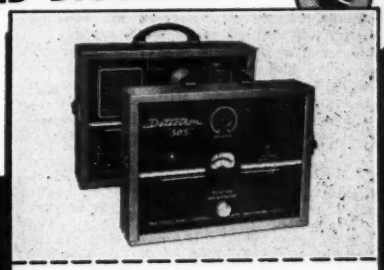
R. W. McIntosh
Dresser

L. R. Carney
Coleman

Coleman Co. of California recently elected LAWRENCE R. CARNEY, former sales manager, to the new position of vice president and general manager. He will supervise the firm's activities in southern California and Arizona.

What does the "Price-Tag" Say?

$5000.00 THE COST OF BLIND DIGGING

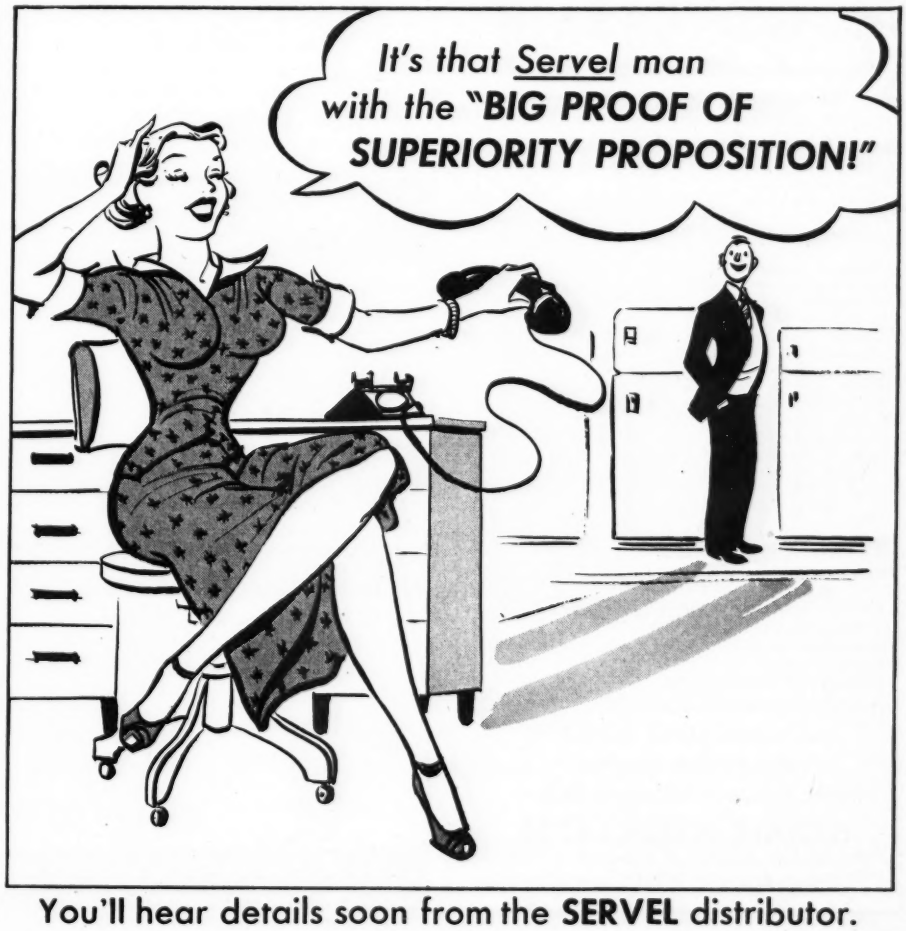


Yes, for mere pennies a day you can have the satisfaction and security of knowing exactly where NOT-to-dig, — where pipes and cables are buried. Why take those unnecessary chances when the economical Detectron "505" gives you pinpoint accuracy plus greater depth. There's nothing like a "505" Pipe Detector!

7¢ per day
for "505" SECURITY
Insurance against Costly Preventable Accidents

THE Detectron CO.
WRITE FOR CATALOG NO. 52

5631 CAHUENGA BLVD. NORTH HOLLYWOOD, CALIF.



You'll hear details soon from the **SERVEL** distributor.

GAS CLASSIFIED

Classified advertising is set in 6-point type, without border or display, at the rate of 15 cents per word per insertion; minimum charge per insertion $3. Box numbers for replies count as 5 words. Count as a word each one letter word and each group of figures. Classified advertising is only accepted when payment accompanies order. Copy and payment must reach publisher's office prior to 10th of month preceding publication.

WANTED — SALES REPRESENTATIVES FOR AN old established line of gas-fired furnaces, boilers, floor heaters, and conversion burners. Open territory in Wisconsin, Minnesota, Missouri, West Virginia, Kentucky, the Carolinas, Georgia and Florida. Write Box 180, GAS, 198 So. Alvarado, Los Angeles, Calif.

FOR SALE — TWO BRUCE MACBETH, 250 H.P., 257 RPM 4 cylinder Vertical Gas Engines. Serial numbers 2066 and 2067. These machines are in first class mechanical condition, and have been overhauled periodically under the supervision of the Bruce-Macbeth Engine Co. Machines will be available by July 1st, 1952. They are equipped with mixing valves suitable for use with either natural or manufactured gas as fuel. Miscellaneous spare parts will be included in sale. The Harrisburg Gas Co., 14 S. Market Square, Harrisburg, Penn.

FOR SALE — ONE 20" SEMET-SOLVAY HYDRAULICALLY operated three-way back run valve. One 16" Semet-Solvay hydraulically operated three-way back run valve. One Sturtevant 7-S Blower 6,000 cu. ft. of air per minute against 42" water column. Electric motor and reduced voltage starter. This equipment is used but in good condition. Offered for sale at approximately 60% discount from original cost. Address inquiries to: Manager — Water, Gas and Electric Dept., Danville, Virginia.

ROBERT E. SEYMOUR has been appointed assistant treasurer of Peoples Natural Gas Co., Pittsburgh. His new duties will include supervision of all accounting procedures in the company's treasury department. Mr. Seymour has been employed by Peoples since 1938.

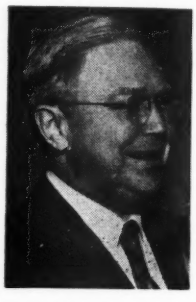
WILLIAM C. SCHNEIDER has been appointed sales representative by Selas Corp. of America, heat processing engineers, Philadelphia, and his territory will include central and western New York state. Mr. Schneider's headquarters will be in Rochester, N. Y.

F. C. DELORENZO, who has been with General Electric Co. in the Air Conditioning Division at Bloomfield, N. J., since 1948, has been appointed supervisor of the division's news bureau. A former Associated Press man, Mr. DeLorenzo has been editing the G-E *Air Conditioning Division News* . . . W. L. SNELTJES has been named manager of sales planning of the G-E home heating and cooling dept. He was formerly supervisor of advertising and sales promotion manager . . .

L. R. FOOTE of Bryant Heater Division, Affiliated Gas Equipment Inc., Cleveland, has been promoted to national sales representative for industrial combustion equipment . . . L. J. Mueller Furnace Co., Milwaukee, has announced the appointment of ERNEST C. BRINKMAN as a sales representative for the St. Louis territory . . .

HARRY H. FILLER, who has served in various foreign and domestic posts with Rheem Manufacturing Co., New York, for the past 18 years, has been named manager of manufacturing . . . Promotion of VICTOR A. HANN to the position of executive vice president and director has been announced by the Welsbach Corp., Philadelphia.

- OBITUARIES -



G. F. Mitchell

GEORGE FRANKLIN MITCHELL, 64, president of the American Gas Assn. and of Peoples Gas Light & Coke Co., Chicago, and director of the latter's three subsidiary companies, died March 26 in Evanston, Ill., following a brief illness. The Peoples Gas subsidiaries are Natural Gas Pipeline Co. of America, Texas Illinois Natural Gas Pipeline Co., and Chicago District Pipeline Co. Mr. Mitchell began his career in the public utility field as a stenographer in the contract department at Commonwealth Edison Co. in 1909. He was promoted to secretary to Samuel Insull, president, and in 1919 was appointed assistant to the president of Peoples Gas.

In 1921, at the age of 33, he was elected treasurer. He became vice president in charge of finance in 1924, and six years later became president. The AGA elected him to its presidency last October at its annual convention.

HALSEY D. POLHEMUS, 65, vice president of Jersey Central Power & Light Co., Asbury Park, for the past quarter of a century, died Feb. 9 in Monmouth. He had been ill since shortly before Christmas. Mr. Polhemus became assistant to the president of the New Jersey utility in 1928 and was promoted to vice president a year later. Although he was due to retire last year, he continued in his official capacity at the request of the board of directors.

FRANCIS FARGO GREGORY, merchandising coordinator of A. O. Smith Corp., died March 8. He had been with A. O. Smith since December 1944, serving consecutively as sales promotion manager, public relations director, and finally as merchandising coordinator.

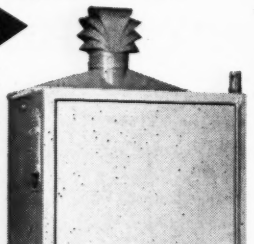
WILLIAM S. AIKEN SR., 67, assistant secretary of the Elizabethtown Consolidated Gas Co., Elizabeth, N. J., died March 18. He had been with the utility for more than 50 years, beginning as a clerk in 1900. He was appointed purchasing agent in 1930 and assistant secretary in 1941.

WILLIAM GEORGE RICH, general manager of coke sales for the Providence (R. I.) Gas Co. for 37 years prior to his retirement in 1948, died March 22. During his lifetime, Mr. Rich held many positions in official and private groups connected with the fuel industry.

WILLIAM J. FARTHING, 61, a director of El Paso Natural Gas Co., died March 30 in Jersey City after a long illness. Mr. Farthing also had served in executive capacities with a number of other organizations.

New Model **GASAIR**

Direct-Fired Vaporizer-Mixer
Steam Vaporizer-Mixer



Complete gas generator in one package.
No electricity or water needed for operation. A steam vaporizing unit can be supplied where steam is available.
Capacity of standard models direct-fired Vaporizer-Mixers - 5M, 10M, 25M, 50M c.f.h.
Heating values 650 to 1500 BTU maintained within 2%.
Pressures—1 lb gauge at 650 BTU to 5 lbs at 1500 BTU.
Pressures from 5 lbs to 45 lbs by compressing air content only.
A.S.M.E. and Code construction.
Direct-fired VAPORIZERS ONLY capacities 40 to 800 gallons per hour.
Over 800 GASAIRS now in use.
Installations for utilities and industry.

Your inquiry should quote BTU and pressure required.

Write for further information—

GASAIR ASSOCIATES
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'Phone KLondike 2-2510 and 2511

LP-GAS CONTRACTING & EQUIPMENT
More than 75 Peacock Plants prove . . .
"There's No Substitute For Experience"
PAUL E. PEACOCK, JR.
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FUEL SUPPLY
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MODEL AB
ONE MAN OPERATION
METAL CABINETS
HEAVY DUTY PERFORMANCE
ONLY
$149.50
FISHER RESEARCH LAB., Inc.
PALO ALTO, CALIFORNIA

Annual Pipeline Issue

Pipeline Construction Maps

Pipeline Firms Laying 3835 Miles Of Line; Plan 11,360 Miles More

In this year's edition of the annual GAS survey of pipeline activity, construction has been divided into two sections, with a map for each: First, those lines and compressor stations planned or proposed; second, those approved, under construction, or completed since Jan. 1, 1952.

Natural gas pipeline construction and planning is building up to another peak following a short period of relative quiet. The steel shortage has shaken out considerably and FPC's certification mills are once more humming at top speed.

New construction in 1952, moneywise, represents a solid $324,973,649; 3835 miles of line are being built; 216,400 hp is being added in new or existing compressor stations.

Planned for future construction are 11,360 miles of line estimated to cost $948,496,716, including compressor capacity of 667,940 hp. Some of these lines may be built or at least started in 1952; others will have to await approval by federal or state bodies.

In brief, all signs point to a continuation of growth.

Description of Planned or Proposed Pipelines

1. ARKANSAS-MISSOURI POWER CO., Blytheville, Ark. 140 miles of line including two lines to connect with Texas Eastern's system: one from just west of the St. Francis river in Clay county, Ark. southwesterly to Rector, Ark.; the other from Campbell, Mo. to Blytheville and Evadale, Ark. Communities to be served: St. Francis, Piggott, Greenway, Rector, Monette, Blytheville, Leachville, Manila, Dell, Luxora, Osceola, Wilson and Evadale, Ark.; Hayti, Steele, Caruthersville, Holland, and Campbell, Mo. Cost: $4,090,835.

2. ASSOCIATED NATURAL GAS CO., Tulsa. Two connections with Texas Eastern at Oron and near Campbell, Mo. To serve Chaffee, Morehouse, Charleston, East Prairie, Kennett, Malden, Holcomb, Clarkton. 101.3 miles. Cost: $1,320,000. Also 52 miles in eastern Missouri to serve Jackson, Portageville, Gideon, Morley, Spoonerville, and Bernie. Cost: $894,320.

3. CAROLINA NATURAL GAS CORP., Charlotte, N. C. About 60 miles of line in North Carolina to serve Hickory, Lenoir, Newton, Conover, Lincolnton, Thomasville, and Lexington. Cost: $800,000.

4. CENTRAL KENTUCKY NATURAL GAS CO., Charleston. 8.8 miles 20-in. to parallel a section from North Means, Ky. to Cincinnati. Cost: $676,000.

5. COLORADO-WYOMING GAS CO., Denver. Awaiting FPC approval for 2 miles of 3-in. between Johnstown and Milliken, Colo. to serve natural to Public Service Co. of Colorado at Milliken. Also for 4 miles 6-in. to serve AEC's Rocky Flats plant located between Golden and Boulder, Colo. Cost: $163,334.

6. JERSEY CENTRAL POWER & LIGHT CO., Asbury Park. 1.4 miles 6-in. main to connect Algonquin Gas Transmission Co. line with the distribution system. Construction is in Denville township. Cities to be served include Boonton, Denville, Dover, Lincoln Park, Mine Hill, Montville township, Mountain Lakes, Parsippany, Troy Hills township, Rockaway, Roxbury township, and Wharton—all in Morris county, N. J.

7. KANSAS-NEBRASKA NATURAL GAS CO. INC., Hastings, Neb. Includes 50 miles of 10¾-in. from Ogallala to North Platte; 9 miles 4½-in. and 5 miles 2⅜-in. Norfolk to Stanton; 9 miles 8⅝-in. running west from near Aurora to a new 16¼-mile 16-in. and 3¾-mile, 12¾-in. line to run from Grand Island south to near Hastings; 5 miles 12¾-in. southeast from near Holdredge, all in Nebraska; 18 miles 8⅝- and 6⅝-in. from McCook, Neb. south into Kansas; and, in Kansas, 4 miles 12¾-in. south from the junction of the firm's lines from Herndon and Atwood; 16 miles of 12¾-in. near Oakley; 74 miles of 8⅝-in. from a point west of Scott City to a point east of Alexander; and Hugoton field gathering system including 6½ miles of 16-in.; 13½ miles 12-in.; 5 miles 10-in.; 7 miles 8-in. 28 miles 6-in. and smaller. New community to be served: Stanton, Neb.

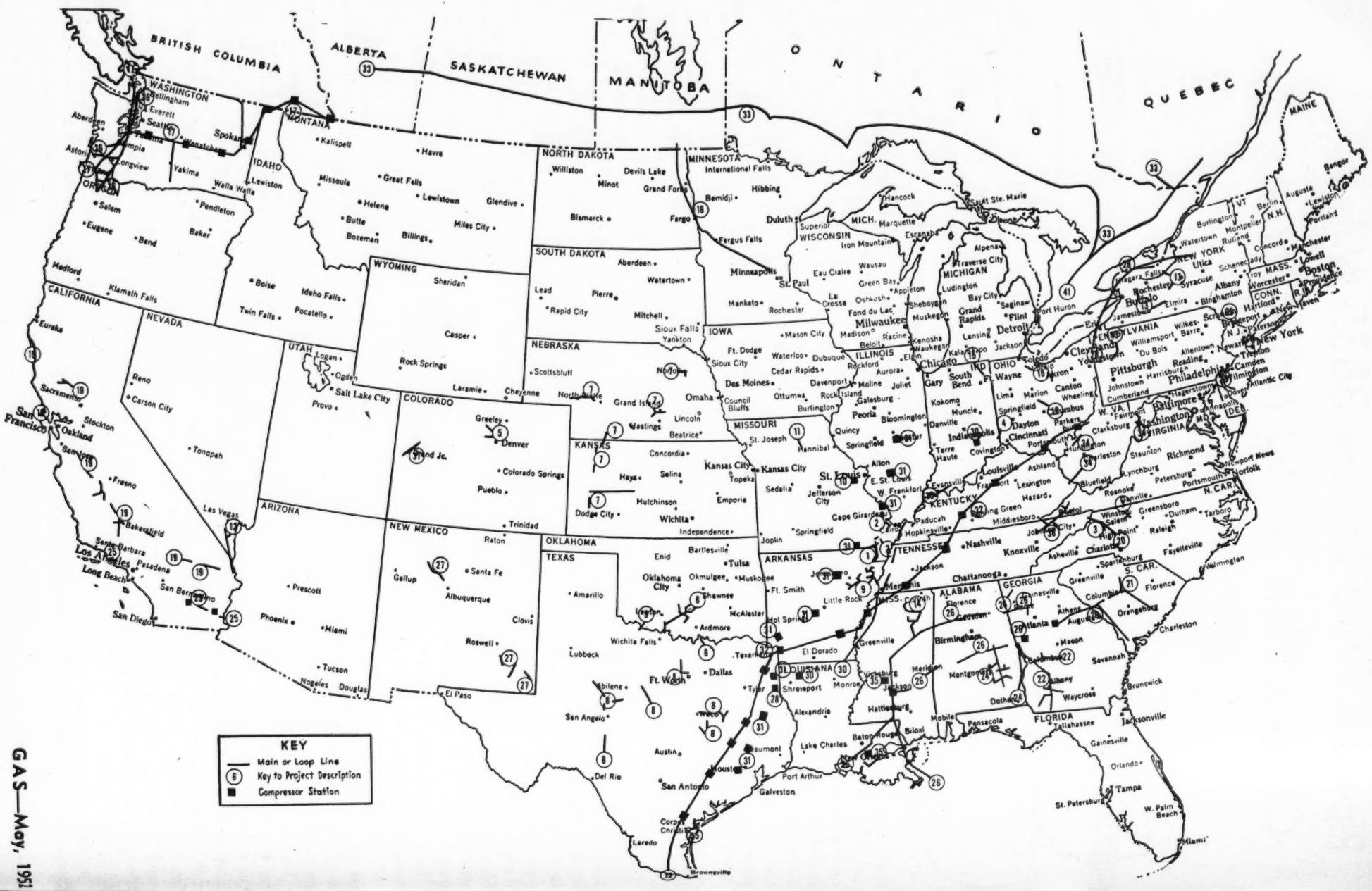
8. LONE STAR GAS CO., Dallas. 263 miles of line to cost about $6 million. No new cities to be served. Includes a 12-in. line from a point in Schleicher county south to the Miers field in Sutton county; an 8-in. tap from near Thorndale southeast to Alcoa plant; a 6-in. loop from Cameron south to Rockdale; a 12-in. loop from just south of Waco to Riesel; a 10-in. line from the Groesbeck compressor station in Limestone county with two 8-in. connections running to the Donie and Oletha fields; a 6-in. line from near Carlsbad to the Carlsbad field; a 10-in. line from a point in Mitchell county to the Jameson field in Coke county; a 10-in. line from Ft. Chadbourne east to the Ft. Chadbourne field; a 6-in. line from near Putnam southeast to Padre gasoline plant; a 12-in. Fort Worth tap from near Saginaw to Fort Worth; an 8-in. line in Grayson county to the Sandusky field in the same county; an 8-in. loop across the Texas-Oklahoma line near Davidson, Okla.; and a 20-in. line from near Petrolia, Texas to the Golden Trend area in Oklahoma, including 10-, 12-, 16-, and 18-in. gathering lines and a 10- and 12-in. lateral to the Carter-Knox field in Oklahoma.

9. MIDSOUTH GAS CO., Little Rock, Ark. Laterals to serve Brinkley, Cotton Plant, Wheatley, Palestine, Forrest City, Wynne, Parkin, Earle, Crawfordsville, Marion, Hughes, Turrell, Gilmore, Tyronza, Marked Tree, Lepanto, Trumann, Marianna, Paragould, and West Memphis, Ark. Includes a lateral from near West Memphis to Texas Gas Transmission Corp.'s line. Cost: $6 million.

10. MISSISSIPPI RIVER FUEL CORP., St. Louis. A 2400-hp compressor station 3 miles west of St. Genevieve, Mo. Cost: $600,000.

11. MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. 26 miles 6-in. Macon to Moberly. To serve Macon.

MAJOR PIPELINES: PLANNED OR PROPOSED



GAS—May, 1952

12. NEVADA NATURAL GAS PIPE LINE CO., Las Vegas, Nev. A 10¾-in. line running

sor station (Homer) to Weaver compressor station (Lucas); 33 miles 20-in. replacement

lines including 10½ miles 22-in. north of Ventura, 14 miles 30-in. between Whitewater and

Plans also include a 16-in. line from the eastern terminus of the existing south line near

12. NEVADA NATURAL GAS PIPE LINE CO., Las Vegas, Nev. A 10¾-in. line running 114 miles beginning on east bank of Colorado river near Topock, Ariz. to Las Vegas, Nev., and a 4-in. branch 4½ miles long from the main line east to Boulder City, Nev. To deliver gas to Henderson, Boulder City, North Las Vegas, Las Vegas and adjacent area. Cost: $2,300,880.

13. NEW YORK STATE NATURAL GAS CORP., Pittsburgh. 19 miles 20-in. Cayuta gate to Ithaca station; 4.5 miles 20-in. Murrysville gate to Tonkin station; 16 miles 20-in. Angelica to north of Rossburg; 3.5 miles 20-in. from north of Rossburg to Iroquois connection; 23.2 miles 20-in. Tonkin station toward Valley gate; 17.1 miles 16-in. Colesburg to county line header; 13 miles 14-in. Auburn to Skaneateles.

14. NORTH CENTRAL NATURAL GAS DISTRICT, Mississippi. (Line to be leased and operated by Mississippi Gas Co., Meridian, Miss.) 99 miles from Southern Natural's system near Louisville, Miss. north to Bruce, Miss. To serve, in Mississippi: Ackerman, Mathiston, Eupora, Walthall, Maben, Mantee, Houston, Vardaman, Derma, Calhoun City, Pittsboro, and Bruce. Cost: $1,950,000.

15. NORTHERN INDIANA FUEL & LIGHT CO., Auburn, Ind. $609,000 for 31-mile line from Auburn to Panhandle Eastern Pipe Line Co.'s line at the Ohio-Indiana state line. New towns to be served include Woodburn, Harlan, Grabill, and Leo. Project is awaiting FPC approval. Auburn, Garrett, Altona, Avilla, Kendallville would benefit too.

16. NORTHERN NATURAL GAS CO., Omaha. 400-mile 24-in. line from Emerson, Monitoba south along Red river valley to near Fergus Falls, Minn., then southeast to near Minneapolis-St. Paul; 2 compressor stations with 5280 hp each. Cost: $24,590,000.

17. NORTHWEST NATURAL GAS CO., New York. $92 million for 1062 miles of line, 44,250 hp in seven compressor stations. To serve Spokane, Seattle, Tacoma, Wash.; Portland, Ore.; Vancouver, B.C. Includes lines from Portland north to Vancouver, from Seattle to Spokane with a branch to Trail, B.C., and from Spokane through northern Idaho to Pincher Creek, Alberta.

18. OHIO FUEL GAS CO., Columbus. $5.3 million for 6000 hp and 80 miles of line. Includes 32 miles 20-in. loop from Treat compressor station (Homer) to Weaver compressor station (Lucas); 33 miles 20-in. replacement from Leesville to New Riegel; and 15 miles 20-in. loop from Carroll to Columbus.

19. PACIFIC GAS & ELECTRIC CO., San Francisco. 210 miles including 8-mile loop in Sonoma county; 20-mile loop in Fresno county; 28-mile line to connect Corning gas field; 9-mile loop near Eureka; 43-mile line to connect Paloma field and loop present system; replace 6-mile main; 10-mile loop of trunk line near Turlock, all in California; 86-mile loop of existing main and add 19,540 hp various locations between Topock, Ariz. and Milpitas, Calif. Cost: $20,165,100.

20. PIEDMONT GAS CO. INC., Hickory, N.C. $500,000 for 34 miles of line from Transcontinental's line near Stanley, N.C. to Hickory. To serve Hickory, Newton, Conover, Lincolnton, Granite Falls, and Lenoir.

21. SOUTH CAROLINA ELECTRIC & GAS CO., Charleston. Transmission system from Southern Natural's line near Aiken, S.C. to serve Columbia, Orangeburg, and Charleston.

22. SOUTH GEORGIA NATURAL GAS CO. 339 miles of line will extend southeasterly from a point near Phenix City in Lee county, Ala. to a point near Albany, Ga. with a branch to Tallahassee. To serve Richland, Americus, Cordelle, Dawson, Albany, Moultrie, Camilla, Pelham, Bainbridge, Cairo, Thomasville, Ga.; and Quincy, Tallahassee, and Havana, Fla. Cost: $8,273,064.

23. SOUTH JERSEY GAS CO., Atlantic City. $285,000 for 11.1 miles of line near Millville, N.J.

24. SOUTHEAST ALABAMA NATURAL GAS DISTRICT. Two lateral lines, one extending in a southerly direction from Southern Natural's system near Wetumpka in Elmore county, Ala. to serve Fort Deposit, Greenville, Rutledge, Luverne, Troy, Brundage, Brantley, Opp, Andalusia, Gantt, Elba, New Brockton, Enterprise. The other line will extend southerly from Southern's system west of Phenix City, Ala. to serve Seale, Eufaula, Abbeville, Newville, Headland, Pinckhard, Newton, Ozark, Dothan, Midland City.

25. SOUTHERN CALIFORNIA GAS CO. CO. AND SOUTHERN COUNTIES GAS CO., Los Angeles. Three loops paralleling existing lines including 10½ miles 22-in. north of Ventura, 14 miles 30-in. between Whitewater and Desert Center, and 6.3 miles 30-in. south of Blythe, all in California. 10,000 hp will be installed in compressor stations at Whitewater and Desert Center. Cost: $4,471,200. No new towns to be served.

26. SOUTHERN NATURAL GAS CO., Birmingham. $76,317,300 for 1255 miles of line and 22,250 hp at new and existing stations. Company would sell to Southeast Alabama Gas District, South Georgia Natural Gas Co., South Carolina Electric & Gas Co., South Atlantic Gas Co., and miscellaneous small towns in Alabama and Georgia. Construction includes a gas supply system from the Sandy Hook field in south Mississippi and from various fields in south Louisiana into the Gwinville field.

This system is a *Y* branch with one 20-in. branch beginning at South Bend, St. Mary parish, La. and extending by way of Donaldsville, La. to Franklinton, Washington parish, La., and a second branch beginning at the southernmost tip of the Mississippi river in Plaquemines parish and extending northwesterly across Lake Pontchartrain to the junction at Franklinton, and from there to Gwinville, Miss. through 67.8 miles of 24-in. pipe. Will gather about 300 MMcf daily and deliver it to the system at Gwinville.

Additional facilities to be installed north and east of Gwinville field to increase delivery capacity by 350 MMcf daily include a 24-in. line 235 miles long to operate at 750 psi from Pickens, Miss. east to a point near Lincoln, Ala. in St. Clair county. This line will have a capacity of 260 MMcf per day and will be served by the present line from Gwinville to Pickens which will be reinforced by two 16-in. loops totaling 58 miles. Capacity will also be added to the south line by means of partial looping of some 212 miles with 18- and 16-in. pipe. Loops on existing laterals include 17.3 miles of 14-in. on the Rome lateral and 13.1 miles of 12¾-in. on the Yates line, both in northwest Georgia.

Certain facilities will be built to supply communities in Southern's present market area, including in Alabama: Blount Springs, Center, Collinsville, Garden City, Leesburg, Midway, Milbrook, Springdale, Union Springs; in Georgia: Clinchfield, Dublin, Eatonton, Hawkinsville, Lafayette, Louisville, McDonough, Perry, Wadley, Warner Robins, Wrens, Wrightsville.

Horsepower to be added includes: Estopinal, La., 3300; Gwinville, Miss., 8100; Reform, Ala., 4400; Columbus, Ga. (new station), 4050; and Macon, Ga. (new station), 2400.

Plans also include a 16-in. line from the eastern terminus of the existing south line near Macon, Ga. extending east about 130 miles to Augusta, Ga. and Aiken, S.C. and a 14-in. lateral extending from this line 120 miles to Savannah, Ga.

27. SOUTHERN UNION GAS CO., Dallas. $2 million for 90 miles of transmission loops and extensions to benefit Albuquerque, Santa Fe, Belen, Portales, Lovington, and Roswell, N.M. New towns to be supplied are Kirtland, Fruitland, and Gallup, N.M. In these three towns, 20 miles of distribution line will be built, costing $225,000.

28. TENNESSEE GAS TRANSMISSION CO., Houston. A 2640-hp compressor station in Carthage field, Panola county, Texas. Cost: $880,000. Also 304 miles 24-in. from Mercer, Pa. to near Utica, N.Y., part of a $128,216,000 program. (The remainder of this program, consisting of 591 miles of loop along existing system, 137,000 hp in existing and authorized stations, 28,000 hp in new stations, and 250 miles of miscellaneous lines is not shown on the map because details were not available.)

29. TEXAS EASTERN TRANSMISSION CORP., Shreveport. 16-in. line from near Linden, N.J. running 8 or 10 miles, splitting with smaller lines running to near Harrison and Jersey City has been proposed.

30. TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Proposed, not approved by FPC: 408 miles 26-in. loop to be built in six sections from Bastrop, La. to near Louisville, Ky. Addition of 26,860 hp at six existing stations and two new ones near Shreveport, La. and Madison, Ind. Cost: $33,750,000.

31. TEXAS ILLINOIS NATURAL GAS PIPELINE CO., Chicago. Wants FPC approval to build six new compressor stations of 14,000 hp each and to add 4000 hp at each of five existing stations for a total of 104,000 hp. Also wants to build a suspension bridge across the Mississippi north of Jackson, Mo. Cost: $52,882,000.

32. TEXAS-OHIO GAS CO., Houston. Planned. 1439 miles of 30-in. from Hidalgo county, Texas through Ark., Miss., Tenn., Ky., Ohio and terminating near Spencer, W.Va. Includes 14 compressor stations developing 135,000 hp. Cost: $184,989,683.

33. TRANS-CANADA PIPELINES LTD., Calgary. 2247.6-mile 30-in. line from Princess, Alta. to Toronto; 24-in. from Toronto to Montreal with a 14-in. branch to Ottawa; 18-in. southwest from Toronto to a point in Ontario. Cost: $253 million, including a 747-mile gathering system not shown on the map and 13 compressor stations totaling 94,160 hp.

34. UNITED FUEL GAS CO., Charleston, W.Va. $2,346,000 for 48 miles of 10-, 12-, and 20-in. production and storage lines from near Mathias and Clendenin, W.Va. and Grundy, Va.

35. UNITED GAS PIPE LINE CO., Shreveport. 11.3 miles 20-in. southwest from the company's main line to the Turtle Bayou and Kent Bayou fields. Cost: $1,461,000. Two compressor stations at Napoleonville, La. and Jackson, Miss. totaling 13,280 hp, and addition of 8000 hp at authorized stations near Montpelier, La. and in Walthall county, Miss. Cost: $5,764,000. 39-mile line from near Refugio, Texas to an underwater field offshore from Ingleside, near Corpus Christi. Cost: $2,735,000.

36. WESTCOAST TRANSMISSION CO. INC., Wilmington, Del. $17,142,000 for a 277-mile line extending south from a point near Sumas, Wash. to Portland, Ore. with branches to Bellingham, Mt. Vernon, Everett, Bellevue, Seattle, Tacoma-Olympia, Centralia-Chehalis, and Kelso-Longview, Wash., and St. Helens, Ore. Project includes one 4000-hp compressor station.

37. WESTERN SLOPE GAS CO., Denver. 49 miles of line to carry gas from a number of gas fields in Mesa county, Colorado, to Grand Junction.

38. EAST TENNESSEE NATURAL GAS CO., Knoxville. 155 miles from Bristol on the Virginia-Tennessee border into northeastern Tennessee with laterals to serve Johnson City, Elizabethton, Greeneville, Morristown, Jefferson City, and Kingsport, Tenn. Cost: $5.8 million.

Description of Pipelines Approved or Under Way

1. ALABAMA-TENNESSEE NATURAL GAS CO., Florence, Ala. 10 miles from Decatur to Athens. To serve Athens. Cost: $70,000.

2. CENTRAL KENTUCKY NATURAL GAS CO., Charleston, W. Va. Has under way 23.9 miles of loop in sections near Lexington, Ky. and Cincinnati. Cost: $1,360,000.

3. HOUSTON PIPE LINE CO., Houston. 151 miles including 60 miles 16-in. from Tom O'Conner field to Edna, Texas and 61 miles 24-in. and 30 miles 18-in. from Texas City to Alvin to Wharton.

4. INTERSTATE POWER CO., Dubuque, Iowa. 33.7 miles from Clinton, Iowa to Hooppole, Ill. Clinton is to be converted from manufactured to natural. Cost: $1 million.

5. LAKE SHORE PIPE LINE CO., Ashtabula, Ohio. 47 miles from Ashtabula to Tennessee Gas Transmission's system near Meadville, Pa. To serve Lake Shore Gas Co. which will supply Conneaut, North Kingsville, Ashtabula, Geneva, Geneva-On-Lake, Jefferson, Perry, North Perry, Madison, and Royal; City of Paineville; and Lake County Gas Co., which will supply Fairport, Mentor, and Willoughby.

6. MICHIGAN GAS STORAGE CO., Jackson. 93 miles from Laingsburg east to Mt. Clemens. To serve Consumers Power Co. Recently completed. Cost: $4.7 million.

7. NEW YORK STATE NATURAL GAS CORP., Pittsburgh. 20 miles 16-in. Leidy station to Driftwood; 12 miles 20-in. Beaver River to route 19; 52 miles 16-in. Utica to Amsterdam; 11 miles 16-in. and 12 miles 20-in. Preston station to Colvin gate. Approved.

8. NIAGARA MOHAWK POWER CORP., Syracuse, N.Y. 55 miles 10¾-in. Fulton to Watertown, $1,991,000; 3 miles 12¾-in. south into Herkimer, $200,000; 20 miles 10¾-, and 24-in. south into Syracuse and North Syracuse, and 1000 hp to be installed with latter project, $1,200,000. All approved and awaiting construction.

9. NORTHEASTERN GAS TRANSMISSION CO., Springfield, Mass. 223 miles Concord, N.H. to a point near Lowell, Mass.; 26 miles 6-in. Fitchburg, Mass. south to Framingham; 100 miles 16-in. Greenwich, Conn. to Springfield; 23 miles 4-in. Granville, Mass. to Torrington, Conn.; and a line to Gloucester, Mass. from TGT's line west of Salem. To serve Concord, Manchester, Nashua, N.H.; Clinton, Gloucester, Leominster, and Fitchburg, Mass.; Torrington, Winsted, New Britain, Wallingford, Derby, Bridgeport, Norwalk, Stamford, Greenwich, Conn. Cost: $9 million.

10. OKLAHOMA NATURAL GAS CO., Tulsa. 82.3 miles including 21 miles 24-in., Depew to Kellyville; 14 miles 8⅝-in. Shamrock to Cushing; 24½ miles 12¾-in. and 3½ miles 6⅝-in. Enid to Ringwood; 8½ miles 12¾-in. Stroud to Depew; and 10.8 miles 16-in. Oklahoma City to Edmond. Cost: $5,186,000.

11. PACIFIC GAS & ELECTRIC CO., San Francisco. 79 miles under way including 44 miles from Salinas, Calif. south to Chular, Gonzales, Soledad, Greenfield, and King City; 12 miles loop between Napa Wye and Shellville; 13 miles from Moss Landing steam plant south to Castroville; 7 miles loop in Monterey county; and 3 miles feeder main near San Francisco. Cost: $2,359,200. 23 miles approved and awaiting construction including 11-mile main south from Castroville; 12-mile transmission line to be replaced in Santa Clara county. Cost: $1,271,700. King City will benefit; the following will receive first natural gas service: Castroville, Chualar, Gonzales, Soledad, Greenfield.

12. PEOPLES NATURAL GAS CO., Pittsburgh. 6 miles 12-in. from Peoples' system at Jeannette, Pa. to near Delmont to carry gas from Oakford; 13 miles 20-in. Portage to Altoona, paralleling a 14-in. line; 4.35 miles 20-in. from Mt. Royal storage area north of Pittsburgh to the city of Pittsburgh; 2.5 miles 14-in. Vinco to Morrellville, Pa., paralleling an existing line, to increase supply to Johnstown. Cost: $1,404,000.

13. PUBLIC SERVICE CO. OF NORTH CAROLINA INC., Gastonia. 165.9 miles of line up to 10¾-in. all for connections with Transco in North Carolina. Laterals or spurs to Asheville, Fletcher, Enka, Bessemer City, Davidson, Statesville, Troutmans, Kannapolis, Burlington, Durham, and Raleigh. Cities to be converted to natural: Asheville, Gastonia, Dallas, Concord, Kannapolis, Statesville, Chapel Hill, Durham, and Raleigh. Cities having no gas service which will receive natural: Shelby, Kings Mountain, Bessemer City, Mount Holly, Belmont, Davidson, Moorseville, Carrboro, Cary, Fletcher, Ranlo, McAdenville, Lowell, Cramerton, Troutmans, Cornelius, Landis, China Grove, Enka, Cliffside, Henrietta, Caroleen, Forest City, Spindale, and Rutherfordton.

14. SOUTHWESTERN VIRGINIA GAS TRANSMISSION CO., Martinsville, Va. 14.8 miles from Transco's system a mile north of North Carolina-Virginia state line to Martinsville, which will receive natural. Cost: $215,000.

15. TENNESSEE GAS TRANSMISSION CO., Houston. Approved and to be built this year: 521 miles 26- and 30-in. loop along present system, including 420 miles of 30-in. in Texas, Louisiana, Arkansas, Mississippi, Tennessee and Kentucky and 101 miles 26-in. in Kentucky and Ohio. Build four new compressor stations and enlarge 18 existing ones, for total of 98,600 hp. Cost: $59 million.

16. TEXAS EASTERN TRANSMISSION CORP., Shreveport. Under way on 30-in. line from Koskiusko, Miss. to Oakford storage area in Pennsylvania. Cost of the 826-mile line and 53,800 hp in six stations is $114,310,000.

17. UNION GAS & ELECTRIC CO., Bloomington, Ill. 31.5 miles from Bloomington to connections with Texas-Illinois line, to serve Farmers City and Le Roy and improve service to Normal. Cost: $900,000.

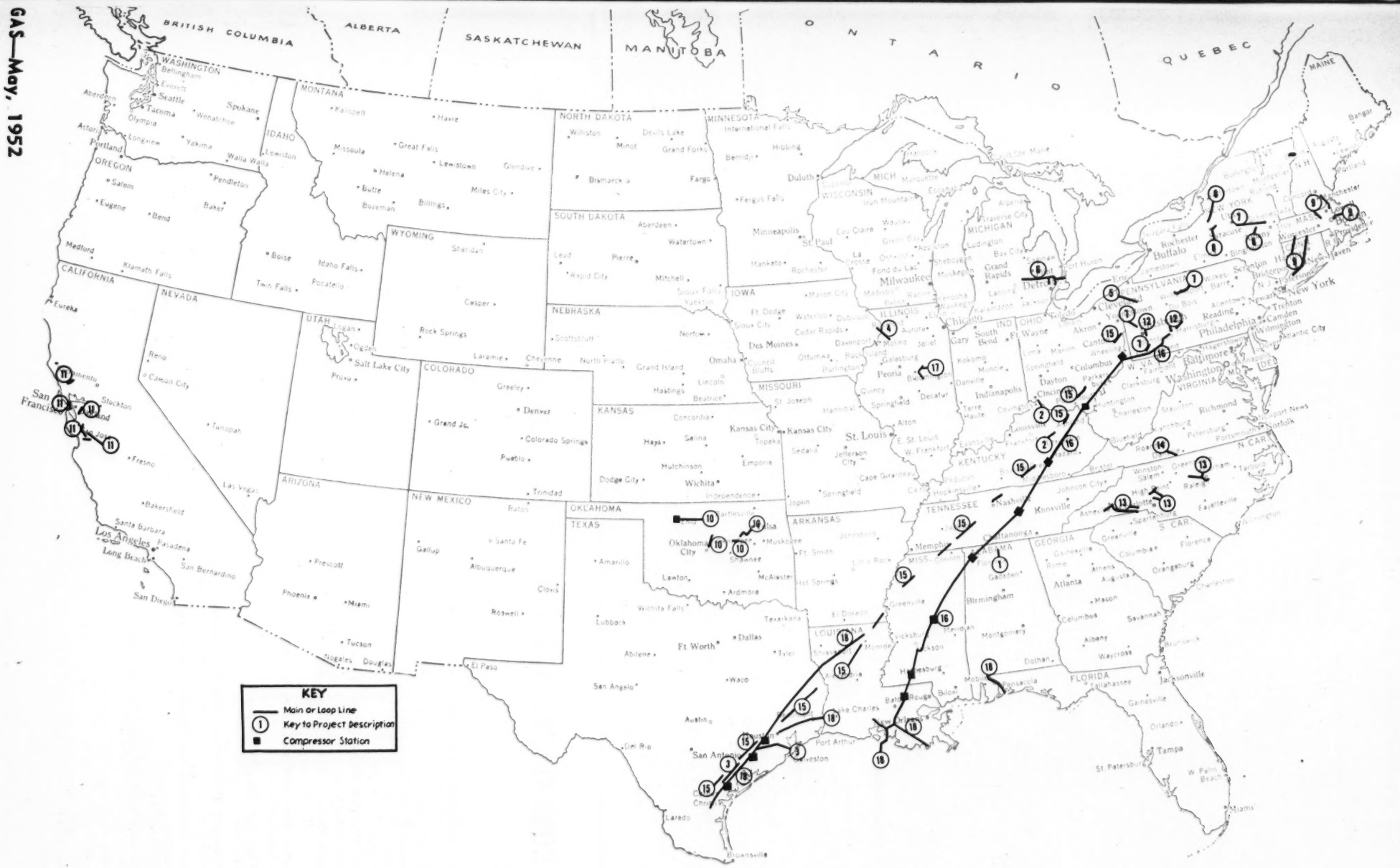
18. UNITED GAS PIPE LINE CO., Shreveport. Under way: A 510-mile, 24-, 26-, and 30-in. line Agua Dulce field, Texas to Perryville La. with 42,200 hp; 305 miles 20-, 24-, 26-, and 30-in. from Pure Oil Co.'s Eugene Island area in Gulf of Mexico through Louisiana to Kosciusko, Miss. with 20,800 hp in 8 stations. Three supply and delivery lines totaling 179 miles from southern and southeastern Louisiana and Mississippi fields to points on latter line. Cost: $111,861,749. Under way: 39 miles 16-in. loop of Pensacola lateral from Baldwin county, Ala. to Escambia county, Fla. and two laterals totaling 11 miles. Tap and sales meter stations for Saufley field, Elgin Air force base, Fort Walton, Niceville, Valpariso, Crestview, and DeFuniak Springs, Fla. Cost: $1,945,000. Under way: 93.7 miles from near Houston to Beaumont to DuPont Chemical Co. near Orange, Texas. Cost: $7 million.

tion to Driftwood; 12 miles 20-in. Beaver River to route 19; 52 miles 16-in. Utica to Amsterdam; 11 miles 16-in. and 12 miles 20-in. Preston station to Colvin gate. Approved.

miles loop between Napa Wye and Shellville; 13 miles from Moss Landing steam plant south to Castroville; 7 miles loop in Monterey county; and 3 miles feeder main near San Francisco.

TRANSMISSION CO., Martinsville, Va. 14.8 miles from Transco's system a mile north of North Carolina-Virginia state line to Martinsville, which will receive natural. Cost: $215,000.

Fort Walton, Niceville, Valparaiso, Crestview, and DeFuniak Springs, Fla. Cost: $1,945,000. Under way: 93.7 miles from near Houston to Beaumont to DuPont Chemical Co. near Orange, Texas. Cost: $7 million.



1952 PIPELINE CONSTRUCTION: APPROVED OR UNDER WAY

CITIES SCHEDULED TO RECEIVE THEIR FIRST NATURAL GAS SERVICE

Alabama

Abbeville
Andalusia
Athens
Blount Springs
Brantley
Brundage
Center
Collinsville
Dothan
Elba
Enterprise
Eufaula
Fort Deposit
Gantt
Garden City
Greenville
Headland
Leesburg
Luverne
Midland City
Midway
Milbrook
New Brockton
Newton
Newville
Opp
Ozark
Pincard
Rutledge
Seale
Springdale
Troy
Union Springs

Arkansas

Blytheville
Brinkley
Cotton Plant
Crawfordsville
Dell
Earle
Evadale
Forrest City
Gilmore
Greenway
Hughes
Leachville
Lepanto
Luxora
Manila
Marianna
Marion
Marked Tree
Monette
Osceola
Palestine
Paragould
Parkin
Piggott
Rector
St. Francis
Trumann
Turrell
Tyronza
West Memphis
Wheatley
Wilson
Wynne

California

Castroville
Chualar
Gonzales
Greenfield
Soledad

Colorado

Grand Junction

Connecticut

Bridgeport
Derby
Greenwich
New Britain
Norwalk
Stamford
Torrington
Wallingford
Winstead

Florida

Crestview
De Funiak Springs
Fort Walton
Havana
Niceville
Quincy
Tallahassee
Valpariso

Georgia

Albany
Americus
Augusta
Bainbridge
Cairo
Camilla
Clinchfield
Cordella
Dawson
Dublin
Eatonton
Hawkinsville
Lafayette
Louisville
McDonough
Moultrie
Pelham
Perry
Richland
Savannah
Thomasville
Wadley
Warner Robins
Wrens
Wrightsville

Farmers City

Illinois

Le Roy

Indiana

Grabill
Harlan
Leo
Woodburn

Iowa

Clinton

Massachusetts

Clinton
Gloucester
Fitchburg
Leominster

Mississippi

Ackerman
Bruce
Calhoun City
Derma
Europa
Houston
Maben
Mantee
Mathiston
Pittsboro
Vardaman
Walthall

Missouri

Bernie
Campbell
Caruthersville
Chaffee
Charleston
Clarkton
East Prairie
Gideon
Hayti
Holcomb
Holland
Jackson
Kennett
Macon
Malden
Morehouse
Portageville
Spoonerville
Steele

Stanton

Nebraska

New Hampshire

Concord
Manchester
Nashua

New Mexico

Fruitland
Gallup
Kirtland

New Jersey

Boonton
Denville
Dover
Harrison
Jersey City
Lincoln Park
Mine Hill
Montville Township
Mountain Lakes
Parsippany
Rockaway
Roxbury Township
Troy Hills Township
Wharton

Herkimer
Mercer

New York

Utica

Nevada

Boulder City
Henderson
Las Vegas
North Las Vegas

North Carolina

Asheville
Belmont
Bessemer City
Carrboro
Caroleen
Cary
Chapel Hill
China Grove
Cliffside
Concord
Conover
Cornelius
Cramerton
Dallas
Davidson
Durham
Enka
Fletcher
Forest City
Gastonia
Granite Falls
Henrietta
Hickory
Kannapolis
Kings Mountain
Landis
Lenoir
Lexington
Lincolnton
Lowell
McAdenville
Mooresville
Mount Holly
Newton
Ranlo
Raleigh
Rutherfordton
Shelby
Spindale
Statesville
Thomasville
Troutmans

Ohio

Ashtabula
Conneaut
Fairport
Geneva
Geneva-on-Lake
Jefferson
Madison
Mentor
North Kingsville
North Perry
Painville
Perry
Royal
Willoughby

Oregon

Portland
St. Helens

South Carolina

Aiken
Charleston
Columbia
Orangeburg

Tennessee

Bristol
Elizabethton
Greeneville
Jefferson City
Johnson City
Kingsport
Morristown

Virginia

Martinsville

Washington

Bellingham
Bellevue
Centralia
Chehalis
Everett
Grand Coulee
Kelso
Longview
Mt. Vernon
Olympia
Seattle
Spokane
Sumas
Tacoma
Yakima
Walla Walla

*Based upon pipeline projects proposed, approved, or under construction. Some of these projects will not be started in 1952.

COMPRESSOR STATIONS TO BE CONSTRUCTED OR AUGMENTED

TOTAL HORSEPOWER 902,820

Atlantic Seaboard Corp., Charleston, W. Va.
3 new stations ..... 16,500 hp
Additions ..... 1,980 hp

Mississippi River Fuel Corp., St. Louis
1 new station ..... 2,400 hp
St. Genevieve, Mo.

Niagara Mohawk Power Corp., Syracuse, N. Y.
New installation ..... 1,000 hp

Northern Natural Gas Co., Omaha
In 2 stations ..... 10,560 hp

Northwest Natural Gas Co., New York
In 7 stations ..... 44,250 hp

Ohio Fuel Gas Co., Columbus
Additions ..... 6,000 hp

Pacific Gas & Electric Co., San Francisco
Additions ..... 19,540 hp

Southern California and Southern Counties Gas Co.'s, Los Angeles
Additions ..... 10,000 hp

Southern Natural Gas Co., Birmingham
Estopinal, La. ..... 3,300 hp
Gwinville, Miss. ..... 8,100 hp
Reform, Ala. ..... 4,400 hp
Columbus, Ga. (new station) ..... 4,050 hp
Macon, Ga. (new station) ..... 2,400 hp

Tennessee Gas Transmission Co., Boston
In 4 new stations and
18 existing ones ..... 98,600 hp
New Carthage field station ..... 2,640 hp
In new stations ..... 28,000 hp
In existing and authorized stations ..... 137,000 hp

Texas Eastern Transmission Corp., Shreveport
In 6 stations ..... 53,800 hp

Texas Gas Transmission Corp., Owensboro, Ky.
At 6 existing and 2 new stations ..... 26,860 hp

Texas Illinois Natural Gas Pipeline Co., Chicago
6 new stations ..... 84,000 hp
5 existing stations ..... 20,000 hp

Texas-Ohio Gas Co., Houston
14 stations ..... 135,000 hp

Trans-Canada Pipelines Ltd., Calgary
13 stations ..... 94,160 hp

United Gas Pipe Line Co., Shreveport
Additions on Gulf-Kosciusko
line in 8 stations ..... 20,800 hp
Additions on Texas-Louisiana line ..... 42,200 hp
2 new stations ..... 13,280 hp
Additions at 2 authorized stations ..... 8,000 hp

Westcoast Transmission Co. Inc., Wilmington, Del.
1 station ..... 4,000 hp

PRICE PIPELINE PORTRAITS

R. K. "BOB" SHIVEL Superintendent, Spread 2

"They can't put a pipeline there," Bob Shivel was told. But as a superintendent on the war-essential 1,700 mile Canol Pipeline in '43 he proved that the "impossible" could be done. In 27 years of pipelining, Shivel has climbed through the ranks: welder helper, welder, foreman and spread superintendent. Married and father of two sons, Bob Shivel knows that when H. C. Price Co. is laying one of America's vital pipelines there are no holidays and no picnics. He's worked in South America's steaming jungles, on the "Biggest Inch" in California's 130° heat, and fought rampaging rivers to stretch the "Toughest Inch" over the precipitous Alleghenies. He, and men like him, are why H. C. Price Co. upholds its reputation as "America's Foremost Pipeline Constructors."

PIPELINE PRICE CONSTRUCTORS

H. C. PRICE CO.

PHILADELPHIA • BARTLESVILLE • NEW ORLEANS

America's Foremost Pipeline Constructors

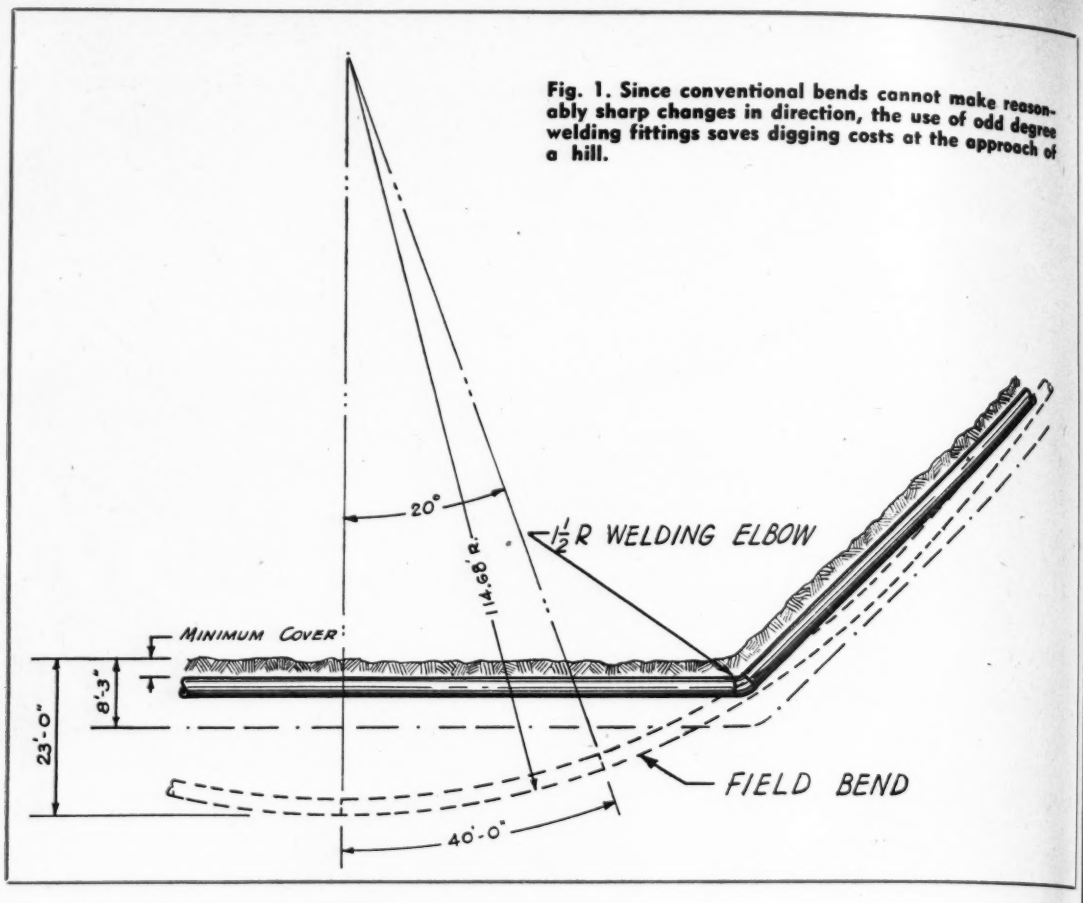


Fig. 1. Since conventional bends cannot make reasonably sharp changes in direction, the use of odd degree welding fittings saves digging costs at the approach of a hill.

In many applications, time and money can be saved in pipeline construction through the use of

Wrought Welding Fittings

By CARL B. McLAUGHLIN and JACK D. TOLLIVER
Tube Turns Inc., Louisville, Ky.

Fig. 2. A welding fitting cut to 22½° permits this 30-in. line to approach a hill without the need for excavating below the depth of the ditch made by the automatic ditching machine.

IN many industries where piping has a principal role, the use of welding fittings has sharply increased the efficiency of piping systems and led to substantial economies. At the same time, standards have been evolved and fabrication procedures have become well established.

Large quantities of welding fittings are also used advantageously in the pipeline industry. But here, design practice and application methods have not been standardized. This has led to difficulties both for the designers of the lines and the manufacturers of components.

In order to cover the subject of wrought welding fittings as comprehensively as space limitations permit, this article will be concerned with:

1. Pipe bends versus wrought welding fittings
2. Where wrought fittings are used
3. Design considerations
   - A. Size
   - B. Strength
   - C. Tangents
   - D. Radius
   - E. Cutting to odd degrees
   - F. Transition pieces

In next month's issue of *GAS*, a sequel to this article will consider compressor station piping under the subheadings of vibration, expansion, and pressure; and welded branch connections and pipeline flanges.

1. Pipe Bends Versus Wrought Welding Fittings

Until rather recent years most small gas pipelines were wrinkle bent or smooth bent in the field and conventional

● *A two-part symposium on bending methods begins here with a discussion of wrought welding fittings and concludes on p. 122 with M. J. Binckley's appraisal of this and other bending methods. As a sequel, Mr. McLaughlin and Mr. Tolliver will write about other uses of wrought fittings next month.*

bending equipment was used for this purpose.

Wrinkle bending of any type is fast becoming an unacceptable method for accomplishing changes in direction. Many engineers have pointed out the high concentration of stresses which are imposed when making bends in this manner.

Experience has proven that regardless of the type of machine used, the bending of pipe will thin the wall on the outside arc and thicken the wall on the inside arc. Naturally, on a small arc of curvature, such as the long radius bend, the magnitude of this is held to a minimum. In addition, pipeline contractors and their inspectors have advised that the bend is partially ovalized, flattening up to 1 in. or about 4% of the diameter.

Wrought welding fittings, on the other hand, are strong and free from stresses at all points, whether their radius is short or long, and they are dimensionally accurate.

During the last five years the trend has been toward piping of larger diameters, up through 36-in. At the same time, there has been a pronounced trend toward the use of high yield strength pipe with relatively thin walls.

The development of special machines for smooth bending large diameter, high strength, light wall pipe has caused considerable interest. They should be credited in part with the satisfactory performance of many of the newer lines. According to some contractors, these machines can make a maximum bend of only 20° in a single 40-ft length of pipe. They report that should the change in direction be greater, two or more lengths of pipe are used. It appears that pipeline contractors' labor and other costs could be lowered by employing a standard welding fitting cut to the desired angle, when the directional change is more than 20°. Fittings of the proper dimension could be carried in stock, ready for immediate use.

Both the modern pipe bending machine and high quality wrought fittings have important places in pipeline construction. Continued careful study by designers, contractors, and the manufacturers of fittings is needed to determine which offers the most economical and efficient way of making directional changes under the various service conditions encountered.

2. Where Fittings Are Used

Wrought fittings have come into such wide use in the pipeline industry that it is not possible to list here all of the places where they provide economical and operational advantages. They are, however, employed in:

1. Compressor stations. The manifolding, pig traps and valve connections are in virtually all cases designed for the employment of wrought fittings.

2. River and rail crossings.

3. Construction of relatively short lines, up to 50 miles in length, where the rental of bending equipment may be prohibitively high for the project. For example, a public utility laid eight miles of 16-in. line, extending from its distribution facilities to a cross-country transmission system. The line was built by the company, and for economy all directional changes were made with welding fittings.

4. Changes in direction over 20° when approaching or coming over the brow of a hill. Where the ditcher has already traversed the area, any additional digging necessitated by the hill must be done by a backhoe or by hand. The use of wrought fittings reduces such digging costs appreciably, for the reason made apparent in *Fig. 1*. *Fig. 2* shows an odd degree welding elbow employed for making a sharp change in direction.

5. Lines being laid in metropolitan areas. Because of space limitations, long radius field bends do not lend themselves to city projects. Welding fittings permit obstructions to be bypassed easily and they are regularly employed for this purpose. The lines recently laid in New York City afford an interesting example of how welding fittings solved problems relating to directional changes in 20-in., ⅜-in. wall piping and 30-in., ½-in. wall piping.

It is interesting to note that some public utility engineers are specifying welding fittings for all changes in direction of more than 10°.

As the flexibility of the use of welding fittings in pipeline construction becomes known, contractors will find many new applications.

3. Design Considerations

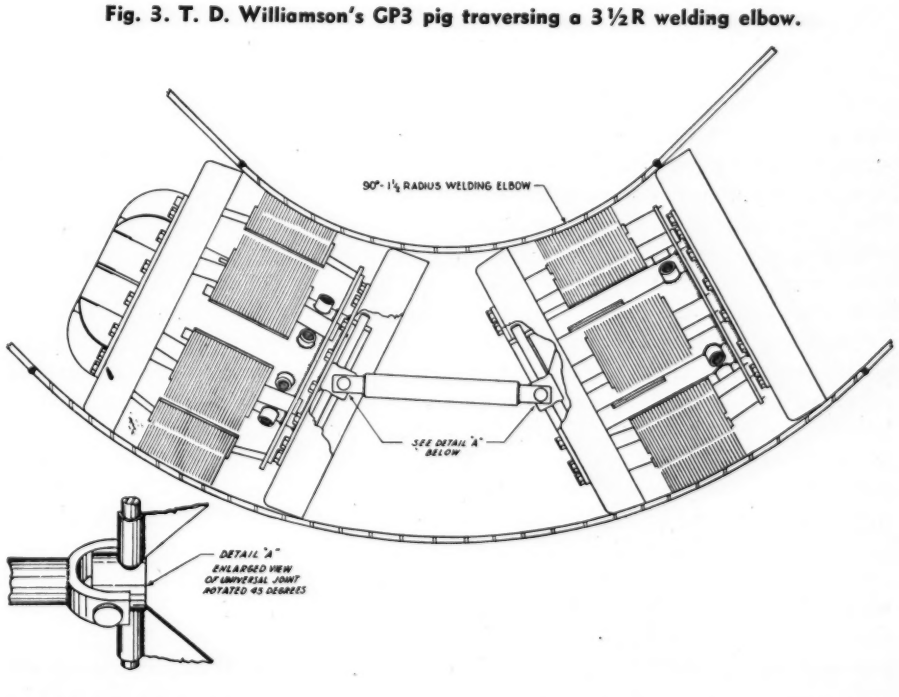
A. *Size.* Most modern pipelines are 16, 18, 20, 22, 24, 26, or 30 in. in diameter. With the uninterrupted growth in the demand for gas, special emphasis is now being placed on the 24-, 26-, and 30-in. sizes.

B. *Strength.* Pipe of various high yield strengths is being used in the construction of gas and oil transmission lines. The high strengths are obtained by cold working or by the addition of alloying elements such as molybdenum, copper, and chrome. However, the demand for higher strength materials which permit reduction in wall thickness at some sacrifice of weldability is steadily rising.

In some cases this has resulted in welding difficulties. When the use of high strength-thin wall material produces welding problems, the recourse is to preheat or stress relieve it. Either operation raises construction costs. It is, therefore, necessary to make a careful study of all items or factors that will be entailed before determining that any given steel is the most economical for the service.

Wrought welding fittings may have the same yield strength and therefore the same thickness as the pipe to which they are to be joined. Or they may have 35,000-psi minimum yield strength (Standard Grade B) and walls sufficiently thick for the service with the yield strength of the fitting being compensated for by in-

Fig. 3. T. D. Williamson's GP3 pig traversing a 3½R welding elbow.



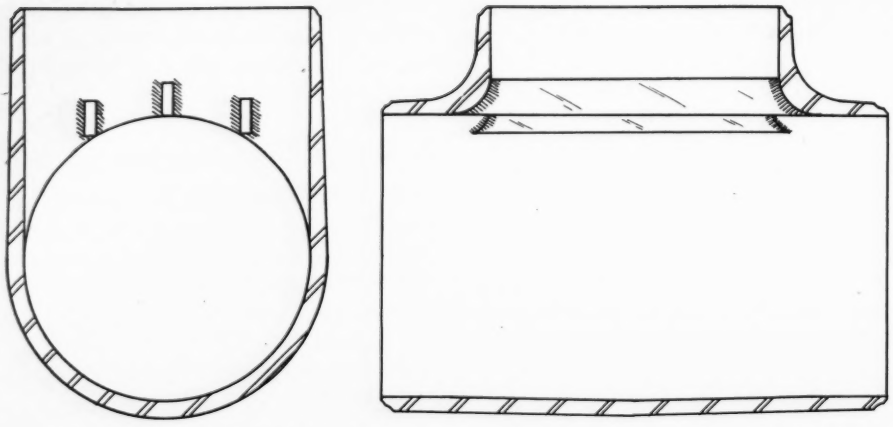


Fig. 4. Metal strips are tack welded across the outlet as a method of minimizing damage to welding tees during scraper operations.

creasing their wall thickness in direct proportion to the relative yield strength of the pipe and fitting materials.

Most of the fittings used in the pipeline industry fall into the lower strength category, but considerable attention is being given to the preference of many engineers for fittings that have the same wall thickness as the pipe. Where the heavier wall fittings are used they are, of course, taper bored to meet the pipe wall thickness, and field reports indicate that satisfactory results have been obtained.

The materials employed in the construction of gas and oil transmission lines are commonly classified by yield strength, as follows:

Yield strength:	35,000 psi minimum
	40,000 psi minimum
	42,000 psi minimum
	46,000 psi minimum
	50,000 psi minimum
	52,000 psi minimum

Welding fittings are available to public utilities and pipeline contractors in all yield strengths up to and including 52,000 psi minimum. The chemical and tensile requirements for the higher strength grades are subject to agreement between the purchaser and manufacturer. The manufacturers of these fittings are constantly endeavoring to secure maximum strength with maximum weldability characteristics.

Therefore, when fittings materials of the higher yield strength are under consideration it is desirable that the user be fully advised of the various analyses that are being offered by the plate producing steel companies. Complete discussions regarding the weldability of the grade of steel in question is urged, so that a full understanding can be reached by the supplier and the user. This follows the practice set up in the API specification for high test line pipe.

The welding fittings manufacturer does not have control over the melting of the steel, or of the installation welding techniques, and cannot assume responsibility for the weldability of the steel selected by the customer.

When some of the special steels are employed in the production of wrought fittings, particularly fittings of large diameters, it is the general practice of manufacturers to produce them from longitudinally welded tubing that has been X-rayed and stress relieved. This is done because of the unavailability of seamless pipe in these special analyses.

C. *Tangents.* There has been considerable discussion regarding the need of tangents on wrought welding fittings, and how long they should be. From time to time requests have been received for tangents from 1 in. through 12 in., and fittings with tangents varying in length throughout this range have been supplied.

Those who favor tangents employ them for two reasons:

1. To permit the use of internal and external line-up fixtures.
2. To permit the use of welding sleeves where improper welding may cause leakage.

Fittings without tangents have been used successfully in the laying of pipelines. Hope Natural Gas Co.'s 20-in. line, outside of Clarksburg, W.Va., is an example. The welding fittings have a radius of 1½ times the pipe diameter, and they accomplish directional changes from 1° 30′ (with a minimum throat dimension of 5 in.) through 90°.

The terrain through which the pipeline runs was completely surveyed in advance and all changes in direction were pre-determined. External clamps were used to join fittings to lengths of pipe outside the ditch. The tie-in welds were made with the aid of internal clamps. Fitup men and welders were able to perform their work without difficulty.

The elimination of tangents has been studied by various designers, engineers, and contractors. Subesequently, they have bought fittings without tangents for their own projects. The fittings were cut in the field to whatever odd degrees called for by the terrain and the installation work proceeded without hitches.

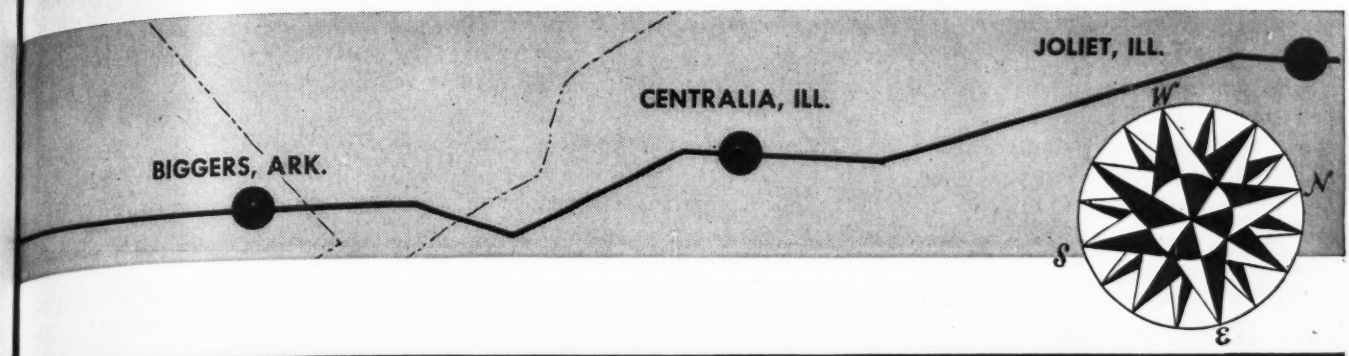
The high quality of field welding today, the use of X-ray, Magnaflux, and other testing equipment, and the competent supervision that is present seem to furnish sufficient assurance that the welding job is being properly done. Money invested in construction facilities, additional personnel, and careful inspection programs brings a better return than money spent in attempting to guard against leakage caused by faulty workmanship. It is, therefore, wise to consider the use of fittings without tangents. In those few special instances where there is an actual need for tangents, the use of 1½R elbow with a maximum tangent of 4 in. on each end is recommended.

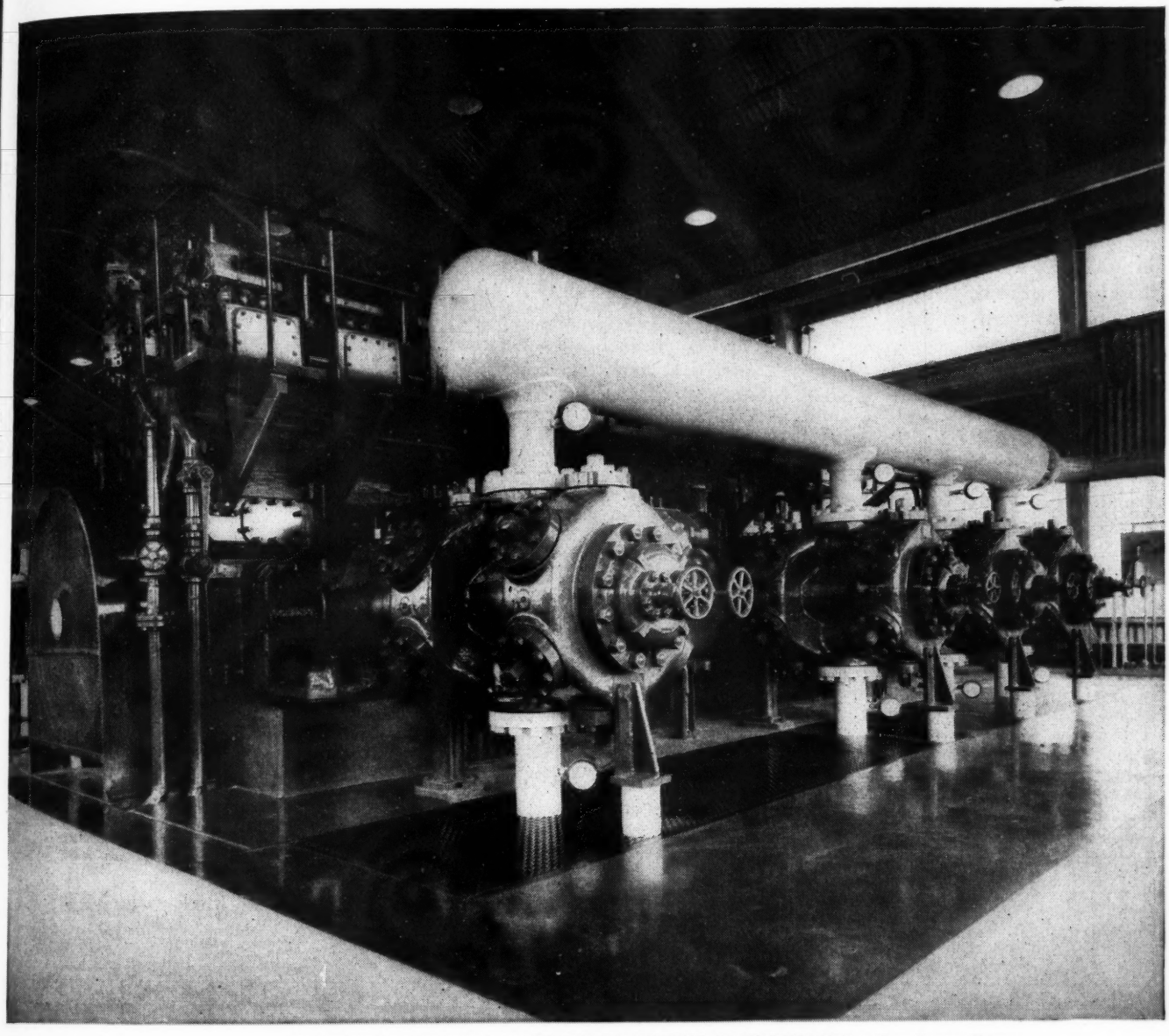
D. *Radius of curvature.* A 3R elbow has been offered to the pipeline industry, and some engineers have indicated a preference for it. Their preference frequently is not based upon a realistic appraisal of all of the factors involved in employing it. These are chiefly concerned with the painting and wrapping operations, pipeline pigs, and material costs.

Automatic coating and wrapping machinery is designed to traverse only those bends which have been processed by field benders, i.e., those on a 10-ft minimum radius. It is not possible for them to traverse either a 1½R or 3R welding fitting. It is hoped that eventually these machines will be built to permit the automatic painting and wrapping of lines equipped with welding fittings. Hand painting and wrapping is now necessary at these points.

The need for standards covering the design of pipeline pigs or cleaning inserts is apparent. There are two general types: (1) those extending in length to some 10 to 12 ft, and (2) a short unit manufactured by T. D. Williamson Inc., Tulsa.

The minimum radius of the bend that those of the first type will traverse is 10 ft. They will not traverse either 1½R or 3R welding fittings. Some pigs of the second type will traverse both 1½R and 3R welding fittings. By referring to *Fig. 4* the flexibility of T. D. Williamson's GP3 pig can be clearly seen. This par-





WORTHINGTON 2000-hp 10-CYLINDER ENGINE-COMPRESSORS at New Caney, Texas, station of the new Gulf Coast-Chicago pipeline of the Texas-Illinois Natural Gas Pipeline Company. These engines use Worthington's uniflo thru-scavenging system—a design thoroughly proved by years of research by Worthington.

PORTABLE COMPRESSORS

RADIAL

GAS ENGINE COMPRESSORS

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WORTHINGTON
Engine Compressors

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ticular pig will go through 1½R elbows and some gate valves.

Some pipeline contractors use pigs of their own design for traversing 1½R elbows. They are about 2 in. shorter than the outside diameter of the pipe. This short pig is usually trapped before it arrives at gate valves, since it will lodge in the wide seat ring spacing. In view of the points brought out in the several preceding paragraphs, there obviously is little to be gained by the pipeline engineer in ordering other than 1½R welding fittings. And it should be borne in mind that the 3R fitting costs from 2 to 2½ times more than the 1½R radius welding fitting. Here again the shorter radius makes possible maximum benefits at the lowest cost.

Where the transmission company or utility expects to use scrapers in a pipeline that has welding tees, the chances of its lodging can be maintained by tack welding metal strips on the inside across the outlet, as shown in *Fig. 4*. When possible, it is recommended that odd degree fittings be spaced three pipe diameters apart.

E. *Cutting to odd degrees.* Another matter to consider is the flexibility of design when cutting wrought fittings to odd degrees. This operation can be performed by the manufacturer or by the contractor in his shop or in the field. (See *Fig. 5.*)

The wall thickness of wrought fittings is maintained at all points and the diameters remain constant throughout the body. Both points are of prime importance to the contractor and engineer.

On some lines surveys have been made and detailed layouts drawn up for each change of direction. This has made it possible to take care of complete requirements for fitting in advance and eliminated cutting in the field. In some cases it is not possible to do this because of the cost of making the surveys, or the fact that the surveys are made as the lines are laid, which preclude the possibility of forecasting specific requirements.

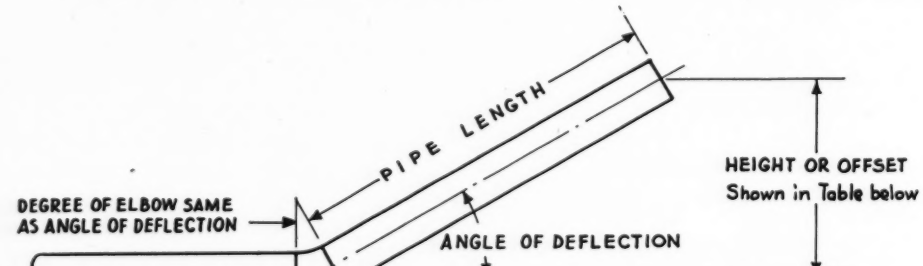
Fill-in requirements are met by cutting the fittings on the job from 45° and 90° elbows on hand. This can and is being done in the field satisfactorily on sizes through 30-in. diameter and up to 1-in. wall thickness. Naturally, the fittings' dimensional accuracy, constancy of wall thickness, outside diameter, and circumference are important in these cutting operations.

A chart has been developed for the assistance of field personnel in laying out the cutting of standard fittings to various odd degrees. It takes into consideration the design of the fitting and the tolerances held by the factory. Copies are available for distribution to public utilities and pipeline contractors.

Fit-up for welding is of maximum importance in this phase of pipeline construction and high manufacturing standards are necessary to keep lineup difficulties to a minimum.

F. *Transition pieces.* The advisability of welding API 5LX-42, 46 and 52 pipe to ASTM A106 Grade B welding fittings has often been questioned. Since these steels have essentially the same chemistry and most pipelines are welded with a high strength rod there should be no adverse effects. However, where the wall thickness of the fitting is increased to equal the pipe strength it is necessary to taper bore the fitting or use a suitable transition piece. Where taper bored welding fittings are involved it is preferable to use a 1:4 taper, which is recognized in all codes as providing a satisfactory transition from one thickness to another. Transition sleeves appear to offer no particular advantage over fittings that have a 1:4 taper.

Fig. 5. Height or offset odd degree selection chart, for assistance in making changes in directions with welding fittings.



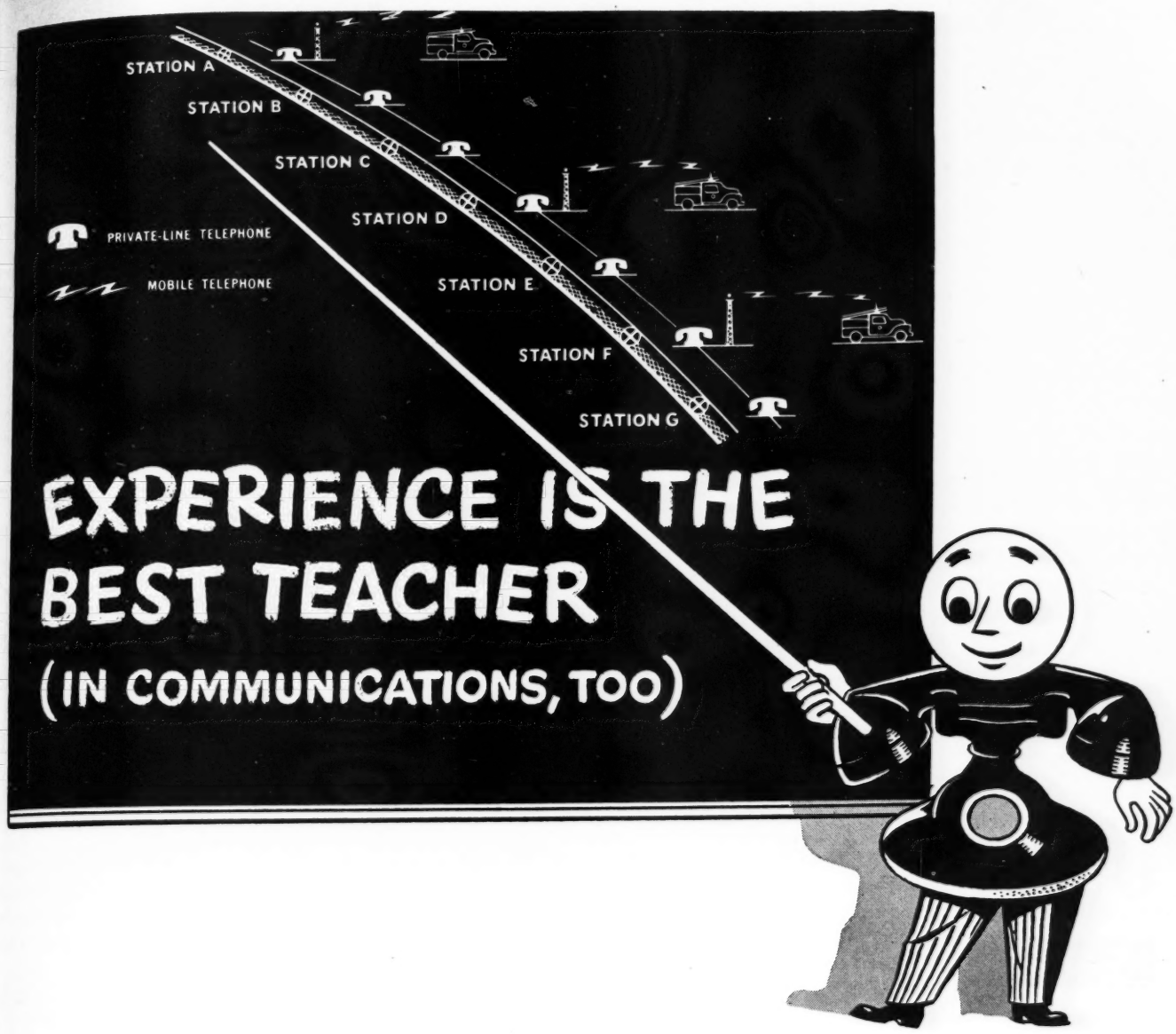
NOTE:
FOR DEFLECTIONS OF PIPE LENGTHS NOT SHOWN IN THE CHART USE THE FOLLOWING FORMULA:

$$H = 2R \sin^2 \frac{\Theta}{2} + L \sin \Theta$$

WHERE:
H = HEIGHT OR OFFSET
R = CENTER TO FACE DIMENSION OF WELDING ELBOW
Θ = DEGREE OF ELBOW
L = LENGTH OF PIPE

NOM SIZE	10'-0" LENGTH							20'-0" LENGTH							30'-0" LENGTH							40'-0" LENGTH						
	1°	5°	10°	15°	22½°	37½°	45°	1°	5°	10°	15°	22½°	37½°	45°	1°	5°	10°	15°	22½°	37½°	45°	1°	5°	10°	15°	22½°	37½°	45°
6"	.17	.87	1.7	2.6	3.9	6.2	7.3	.33	1.8	3.5	5.2	7.7	12.3	14.4	.51	2.6	5.2	7.8	11.5	18.4	21.4	.70	3.5	6.9	10.4	15.3	24.5	28.6
8"	.17	.87	1.7	2.6	3.9	6.3	7.4	.33	1.8	3.5	5.2	7.7	12.4	14.4	.51	2.6	5.2	7.8	11.5	18.5	21.5	.70	3.5	6.9	10.4	15.3	24.5	28.6
10"	.17	.87	1.7	2.6	3.9	6.3	7.4	.33	1.8	3.5	5.2	7.7	12.4	14.5	.51	2.6	5.2	7.8	11.5	18.5	21.6	.70	3.5	6.9	10.4	15.4	24.6	28.7
12"	.17	.87	1.8	2.6	3.9	6.4	7.5	.33	1.8	3.5	5.2	7.7	12.5	14.6	.51	2.6	5.2	7.8	11.6	18.6	21.7	.70	3.5	7.0	10.4	15.4	24.6	28.7
14"	.17	.87	1.8	2.6	3.9	6.4	7.6	.33	1.8	3.5	5.2	7.8	12.5	14.7	.51	2.6	5.2	7.8	11.6	18.6	21.7	.70	3.5	7.0	10.5	15.4	24.7	28.8
16"	.17	.87	1.8	2.7	4.0	6.5	7.7	.33	1.8	3.5	5.2	7.8	12.6	14.7	.51	2.6	5.2	7.8	11.6	18.7	21.8	.70	3.5	7.0	10.5	15.4	24.7	28.9
18"	.17	.87	1.8	2.7	4.0	6.5	7.7	.33	1.8	3.5	5.3	7.8	12.6	14.8	.51	2.6	5.2	7.8	11.6	18.7	21.9	.70	3.5	7.0	10.5	15.4	24.8	29.0
20"	.17	.87	1.8	2.7	4.0	6.6	7.8	.33	1.8	3.5	5.3	7.8	12.7	14.9	.51	2.6	5.2	7.9	11.6	18.8	22.0	.70	3.5	7.0	10.5	15.5	24.8	29.0
22"	.17	.87	1.8	2.7	4.0	6.7	7.9	.33	1.8	3.5	5.3	7.8	12.7	15.0	.51	2.6	5.2	7.9	11.7	18.8	22.0	.70	3.5	7.0	10.5	15.5	24.9	29.1
24"	.17	.87	1.8	2.7	4.0	6.7	8.0	.33	1.8	3.5	5.3	7.9	12.8	15.0	.51	2.6	5.2	7.9	11.7	18.9	22.1	.70	3.5	7.0	10.5	15.5	25.0	29.3
26"	.17	.87	1.8	2.7	4.1	6.8	8.0	.33	1.8	3.5	5.3	7.9	12.8	15.1	.51	2.6	5.3	7.9	11.7	18.9	22.2	.70	3.5	7.0	10.5	15.5	25.0	29.3
30"	.17	.87	1.8	2.7	4.1	6.9	8.2	.33	1.8	3.5	5.3	7.9	12.9	15.3	.51	2.6	5.3	7.9	11.7	19.0	22.3	.70	3.5	7.0	10.5	15.6	25.1	29.4
36"	.17	.87	1.8	2.7	4.2	7.0	8.3	.33	1.8	3.5	5.3	8.0	13.1	15.5	.51	2.6	5.3	7.9	11.8	19.2	23.6	.70	3.5	7.0	10.5	15.6	25.3	29.6

Dimensions shown in feet



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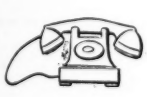
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Which Bending Method

● *Unless trench digging adjustments make them unnecessary, pipe bends in a line may be so numerous as to require considerable advance analysis of costs.*

By M. J. BINCKLEY
Administrative Engineer
Southern California Gas Co.
Los Angeles

DURING the planning phase of a pipeline's construction, selection of appropriate methods of forming the angles and bends required should be given early consideration in order to assure availability of the necessary material, equipment, and tools. Since it is not unusual to find an average of 25 bends per mile required in a normal cross country transmission line, the total cost of this part of the construction is not insignificant.

Exclusive

Some companies have applied a direct approach to this problem by grading the working strip and digging the trench to such depths that only a minimum number of bends are required. Any discussion of the economics of such a plan is not considered appropriate in this article, but the relative merits of the five most commonly used methods of making angles in a large-diameter pipe will be considered.

The use of heat in bending pipe in the field is almost as old as the pipelining industry and this method has certain features that should not be overlooked since it might be found that, due to the peculiar circumstances affecting construction of any given pipeline, this method would prove more economical and would produce results as satisfactory as those attainable by the use of newer methods.

Hot wrinkle bending can be accomplished in the field with the normal equipment, tools, and personnel found on any large pipeline construction project requiring no special equipment other than some means of economically supplying the high demand for heating fuel. Hot wrinkle bending has an important advantage in that each section of pipe to be bent is worked on at the point in the line where the bent section will later be installed, eliminating the need of moving the pipe to the point of bending and back to the point of installation. Another minor advantage is that the destruction of coating on a yard wrapped pipe is held to a minimum.

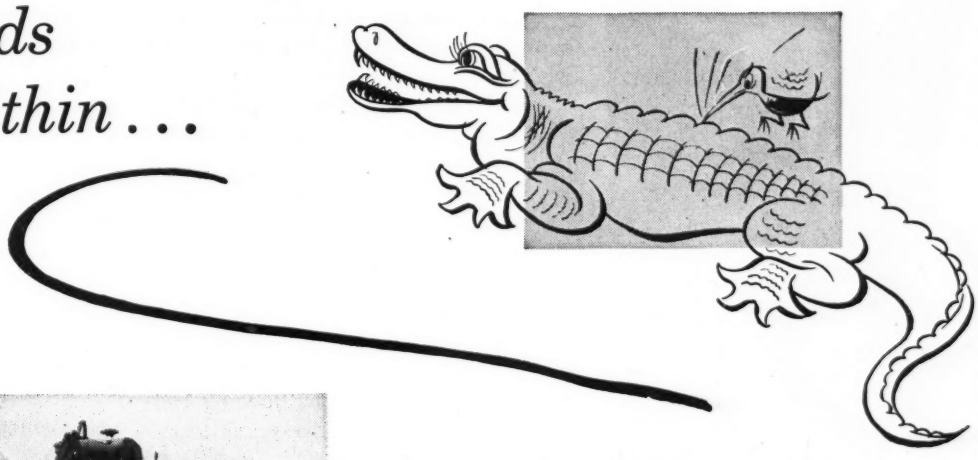
In considering the importance of the disadvantages of hot wrinkle bending, it is necessary to consider the physical and chemical characteristics of the steel and the method used in the manufacture of the pipe. Where a ductile steel is used and the pipeline is to be operated at pressures producing only low to moderate stresses, the use of hot wrinkle bending probably will not produce any point of stress concentrations in the pipeline.

In the construction of all of the large-diameter pipelines (20- to 30-in. diameter), built by this company since 1947, pipe made with high carbon-manganese content steel and manufactured by the cold expansion method has been used. Most of these lines were designed to operate with pressures which produce stresses close to the maximum allowable under the ASA Piping Code. These lines

---

● *Complementing the article on "Wrought Welding Fittings," appearing on p. 110, Mr. Binckley discusses the methods his company has used for achieving bends, and evaluates each method in relation to the job to be performed.*

Like the 'Gator's tough skin that shields what's within . . .



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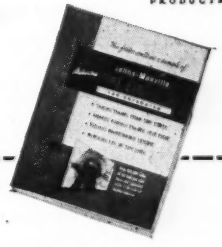

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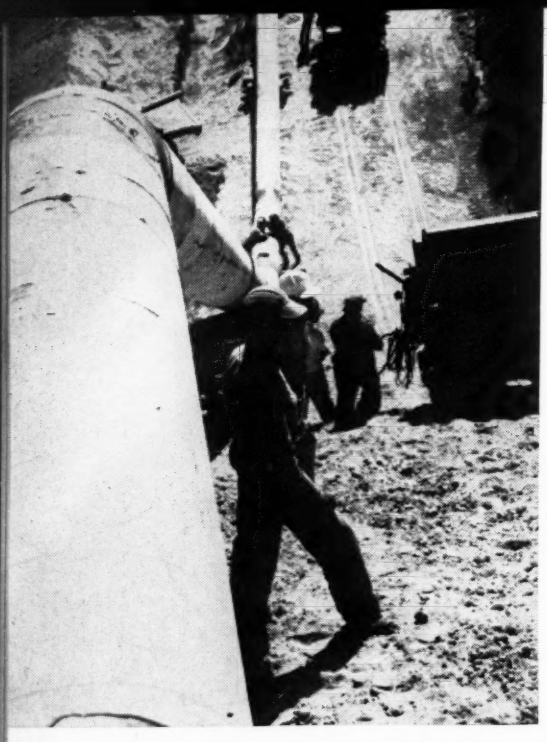


Wrought welding fitting is used on Biggest Inch loop where high compression forces may occur.

were also designed for daily operation under a pack and draft method.

In cases of this kind, the use of hot wrinkle bending deserves a careful study before adoption since, in the application of heat to bring the metal to a proper bending temperature, the heated portion of the pipe wall is annealed by the heat, and the tensile strength of the cold work steel is consequently reduced to a considerably lower value. The result of this, of course, is that throughout the length of the pipeline there will be at each wrinkle a relatively weak point in the pipe wall, these areas having a dimension along the axis of the pipe of about 1 ft. The sharp crest of the wrinkle invites consideration, since with the line operating under a pack and draft method, wide daily fluctuations in pressure will be normal and any working of the pipe will tend to produce movement with a concentration of stresses at each wrinkle crest.

Conditions in the field may prove to be the factor that will rule out the use of the hot wrinkle method. In country where winds of even moderate velocity are common, it will be extremely difficult to bring the relatively large surface of pipe wall up to the temperature required to produce a bend of suitable crest height and uniformity in section throughout its length. The high labor and equipment costs due to the slowness of this method weigh heavily against its adoption.

The first important step in the development of a method of bending to take the place of hot wrinkle bending was the production of a cold wrinkle machine. The most important features of this machine were its ability to make a bend in a matter of minutes and a reduction in the number of men required to operate the machine and auxiliary equipment.

Its use had the added advantage of eliminating the need of heating the pipe with the resulting annealing of the steel, and the machine could be used under any kind of climatic conditions with uniform results. The segmental bending shoe used in the cold wrinkle machine assures formation of wrinkles in the pipe at precisely the point desired and of uniform cross section with complete control of the height of the wrinkle maintained by the operator.

This method of forming bends has its disadvantages. The cold bending during the formation of the wrinkle constitutes an additional cold working of the metal, which during its processing into pipe has already been cold worked to close to the maximum permissible extent. It is conceivable that this additional cold working, concentrated in the small area of the pipe wall which forms the wrinkle, can constitute a weakness in the system since a dangerously high concentration of stresses may occur at these points. Where a pipeline is operated with wide fluctuations in pressure, constant changes in stresses and the possibility of actual movement in the less ductile metal may result in the formation of cracks resulting in ultimate failure.

In the use of the cold wrinkle machine, the positioning of the longitudinal weld with respect to the wrinkle must be considered; this requires some additional handling of the pipe with resulting higher costs. Experience has shown that the longitudinal weld should not be within the wrinkled portion of the pipe as cracking of the weld metal might occur. With the working of the pipe, these small cracks may grow in time to the point of failure.

Although the machine is heavy it can easily be moved along the working strip. However, it is generally found more practical to locate the machine at some convenient working area along the line. Each section of pipe to be bent is transported to the bending machine and then returned to the point on the line where it will later be installed. When the transport distance of pipe exceeds the practical limit, the machine is moved ahead to another working area.

Where the pipe has been yard coated, the forces exerted by the bending shoes on the pipe will result in severe damage to the coating. The extent of this damage will depend upon the type of coating materials, weather conditions and, of course, the care exercised by the operating crew in avoiding damage to the coating while handling the pipe.

Where the pipeline is to be constructed in city streets or other areas where the working space is restricted, the cold wrinkle machine is not entirely suitable. It is impractical to operate the machine immediately alongside the ditch bank under these conditions, and the necessity of transporting the bent sections from the machine through a narrow, congested working area in a city street might easily result in such extensive delays on the overall progress of the job that the cost will mount prohibitively. Unless the cold bending machine is locally available in the vicinity of the job, the high shipping costs will probably result in its rejection as a means of bending pipe on relatively short jobs.

The development of the smooth bending machine was another improvement over the hot wrinkle method. The machine is substantially the same as the cold wrinkle machine, the principal difference being that a smooth shoe is used which produces a slight deformation of the pipe by changing its cross section from circular to slightly elliptical and by a flow of metal in the pipe walls. The total deflection desired in a pipe section is obtained by producing a number of small bends along the length of the section. This reduces the amount of cold working at any given point and results in a long radius bend. The absence of severe distortions of the pipe wall at any point eliminates the possibility of high concentrations of stresses in the line.

The amount of deflection that can be properly permitted in any section of pipe will be limited by the physical characteristics of the steel and some acceptable maximum difference in the major and minor axes of the resulting ellipse. A prohibition against bending within reasonable distances of the ends of the pipe section and of any girth weld in the section appears sound although this does appreciably reduce the amount of total deflection that can be bent into any one pipe section.

The speed of operation and the cost of equipment and personnel required in using the smooth bending machine are about the same as in the case of the cold wrinkle bender, and the machine has about the same limitations with respect to portability and working area required. Compared with the cold wrinkle machine, the smooth bender causes damage

to coating over a greater area but the damage is not as severe, especially where a suitable coating material is used and favorable climatic conditions exist. For jobs of short length, the smooth bending machine might be ruled out because of high shipping costs, if it is unavailable locally.

The use of wrought welding fittings has been common since their introduction many years ago. By the use of such fittings, almost any problem can be solved where angles are required in a pipeline, but due to the relative high cost of the material and the cost of cutting and preparing the ends and welding the segments into the line, this method cannot always meet the test when the most economical installation is being sought.

From a design standpoint, the wrought welding fitting has none of the disadvantages of previously discussed methods as it introduces no condition in the pipeline which would result in a stress problem. A segment of a welding fitting, if carefully cut along radial lines with the ends properly prepared for welding, can be lined up with but little more time and effort than are required to make a straight butt-weld in the line pipe. Since the wall thickness of the fitting is generally greater than that of the line pipe, it seems to be a good practice to back weld the joint between the welding fitting segment and the line pipe and eliminate any abrupt changes in surface at that point.

The principal disadvantage in the use of wrought welding fittings, aside from their cost, results from the difficulty of accurately cutting the segments. This can be done by the careful use of scarfing rings properly designed for mounting on the surface of the fitting. Errors in cutting the segments are expensive, both in wastage of costly material and loss of time.

In open country construction, conditions frequently will be found where structurally the wrought welding fitting is the only means available to resist the high compression or tensile stresses which might occur at the angle. Wrinkle bends or smooth bends by their very nature have distorted the round pipe. If added stresses are introduced, continued deformation of the pipe might occur. Under the congested working conditions found in city streets, where it is frequently necessary to assemble the pipe in the ditch, when crossing under existing substructures, the welding fitting offers a very acceptable solution.

It will frequently be found that, although it appears that a section of pipe bent by either the wrinkle or smooth bending method will fit in its place underground and not be in conflict with the other substructures, the placing of the bent section in the selected position is impossible unless it is cut and reassembled in the ditch or the conflicting obstruction is removed.

The use of miter angles in pipeline practice pre-dates the development of the wrought welding fitting. On large diameter lines there are many places where the use of miter angles, if limited in angularity, will give a satisfactory job at a minimum cost. Tests conducted on carefully prepared miter angles have indicated that stresses in the miter angle resulting from internal pressures in the line do not reach significant proportions where the deflection of the miter angle is 10° or less. It has also been found that the practice of permitting the mitering of one of the two ends of the sections to be joined is not unsound provided the maximum deflection of such a miter angle is 3° or less.

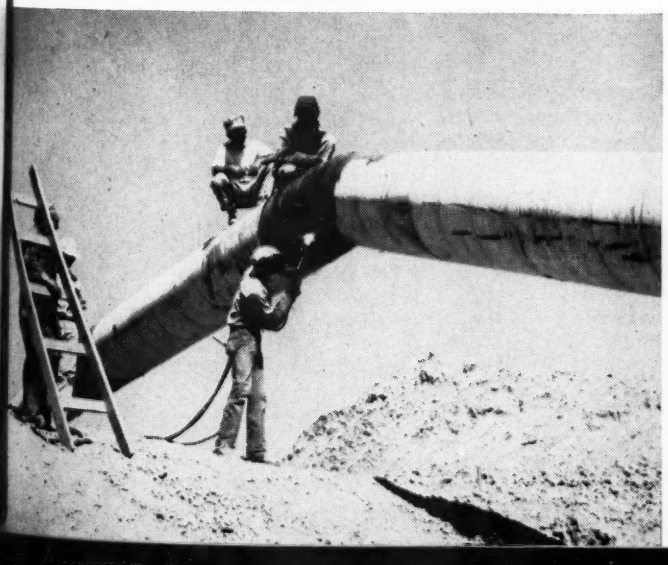
The miter angle, where it is used within the above limits of deflection appears to have some advantage over the use of small segments of wrought welding fittings, both as to cost of material and fabrication, and ease of construction. Back welding of the miter joint appears to be justifiable as insurance. Factors which should be considered with relation to acceptance of miter angles are the availability of suitable scarfing rings equipped with accurate templates for the cutting of the miters and the use of well qualified men to operate this equipment.

Unless the ends to be joined in a miter angle are prepared with the same high degree of accuracy as the factory ends of the pipe, it will be impossible to obtain a welded joint which will meet the standard of welding required in the normal line pipe weld. To permit a lower standard of welding in the miter weld is obviously unwise. In open country construction where wrinkle or smooth bending equipment is available, the miter angle will not be found to be applicable except in extremely unusual conditions. In congested city construction the miter angle offers a fast, economical method of construction in the many problem areas which will be encountered.

The use of wrought welding fittings and miter angles is advantageous from the standpoint of labor and equipment costs and they are suitable for construction in street work or in the country to meet the unusual situation or in the case of welding fittings where high stresses might occur at the angle point. Hot wrinkle bends still have their place in construction where the characteristics of the steel, operating pressure of the line, and construction conditions are favorable.

The cold wrinkle or smooth bending methods are certainly the most suitable methods for general use in the construction of long, cross-country lines. The relative merits of the latter two methods, however, must be gauged by other factors, such as the characteristics of the metal, method of operation of the line, and whether the pipe is to be coated prior to bending.

Wrought welding fitting in use at a sharp angled peak on Whitewater-Puente California line.



Smooth bending machine shown in operation on Southern California-Southern Counties line.

VALVE POSITIONERS

Part 2
Design and Operation

Last month Mr. Beard discussed applications of valve positioners and the ten most important conditions under which they are specified. This month he describes the two basic types, as well as other designs, and shows in detail how each operates.

By C. S. BEARD
Ebasco Services Inc.
New York

EACH manufacturer of valve positioners has designed his equipment according to his own conception of how a valve positioner should function. All those presently known to be on the market are commercially proven, so no comparisons will be made here. Instead, each will be illustrated and the method of operation will be outlined briefly.

Exclusive

Representative Types

The following are representative of the type that converts the controller output to a proportional deflection and compares this to a proportional deflection created by the stroke of the valve stem.

Bristol Positioner *(Fig. 5)*
Foxboro Valvactor *(Fig. 6)*
Taylor Precisor *(Fig. 7)*
Brown Valve Positioner *(Fig. 8)*
De Zurick Positioner *(Fig. 9)*

The following instruments convert the controller output to a force which can be compared to another force set up by the movement of the valve stem.

Fisher Positrol *(Fig. 10)*
Bailey Positioner *(Fig. 11)*
Moore Valve Positioner *(Fig. 12)*
Republic Operator *(Fig. 13)*
Masonielan Valve Positioner *(Fig. 14)*

Certain valve positioners have been designed so that either by physical characteristics or by function, they are different from the standard. At least one valve positioner has been designed to be an integral part of the top plate of the diaphragm case. One of these is pictured in *Fig. 15.*

Other Designs

One valve positoner application evades the two classifications listed. The Conoflow Rotomotor, as explained in *Fig. 16,* has adapted the positioner principle to a pneumatic motor in order to position the stem of large valves. This approach has many applications and would have been very acceptable some years ago, when it was necessary to convert a group of large electric motor operated gate valves to pneumatic motor driven valves in order to make a southern California compressor plant explosion-proof.

Another example of deviation from standard design makes it possible to translate a linear controller output to an-

(Continued on p. 142)

TYPE 1. **Converts controller output to a proportional deflection and compares this to a proportional deflection created by the stroke of the valve stem.**

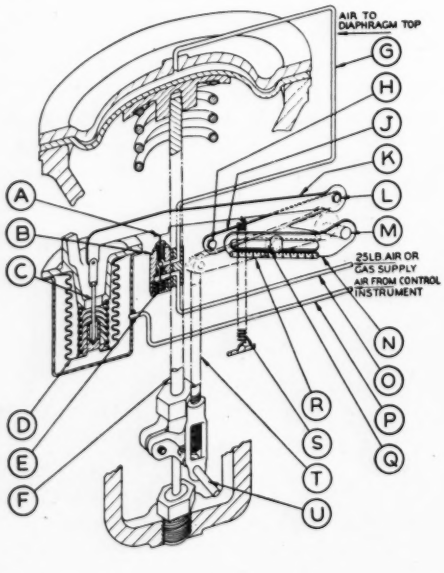


Fig. 5. Bristol Positioner. A supply of dry, clean, regulated air or non-corrosive gas (25-lb maximum pressure) is led through pipe O to pilot valve B which controls the flow through pipe G to the diaphragm of the control valve. The pilot valve is normally kept open by spring E and is closed by the movement of floating lever K acting on stem A.

By means of this floating lever, the pilot valve is operated jointly by the pressure of the air from the control instrument and the movement of the stem of the control valve. (See connection at U.) Air from the control instrument coming to the spring loaded bellows D through pipe P gives a movement to the bellows which is in proportion to the pressure from the control instrument. This movement is transmitted through rod C to the left hand end of floating lever K. The other end of lever K is pivoted at L to lever J which rotates about stud H as an axis.

Lever J in turn is rotated by a bell crank with axis at M, in which arm R is rotated by the movement of the control valve stem acting through pin U and connecting rod T, and arm N transmits the movement to lever J through pin Q. Arm N has a slotted adjustment for changing the position of pin Q and thereby adjusting the movement of lever K relative to the travel of the valve stem F. This adjustment will handle control valve stem travels from ¼- to 3-in. Spring S holds lever J against pin Q and also takes up the back lash in the system of levers.

In the illustration, pilot valve B is shown in a throttling position, and the control valve is in some mid-position proportional to the air pressure on bellows D. The system is in a state of equilibrium with the air escaping through the exhaust port and around stem A as fast as it enters through the inlet port of the pilot valve. Assume now that the pressure of the air from the control instrument increases.

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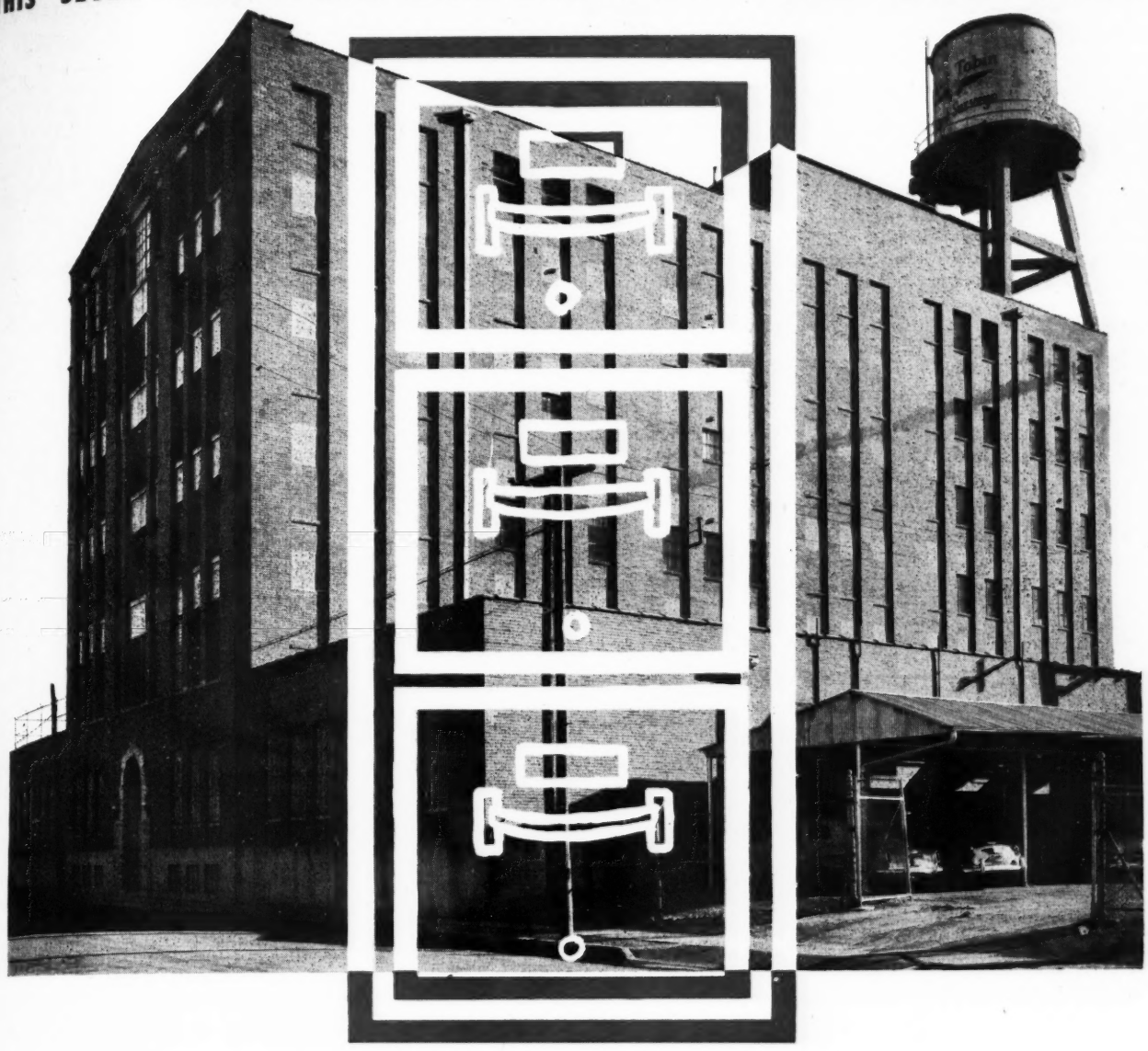

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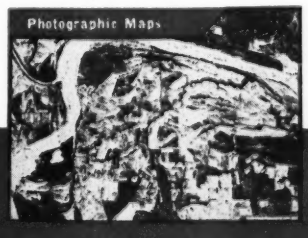

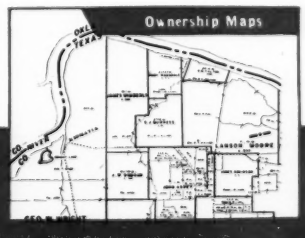

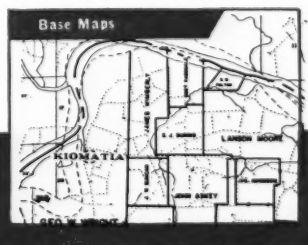

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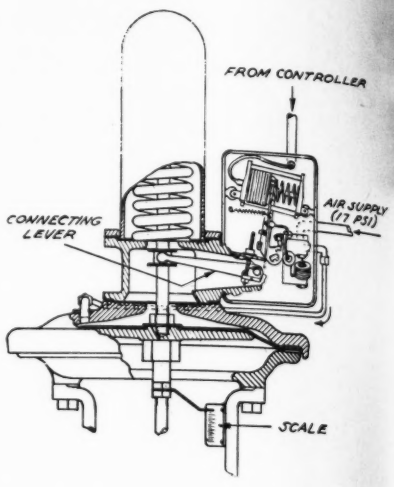
This increase in pressure will compress bellows D and move the left hand end of lever K upward, thereby opening the pilot valve wider and increasing the pressure on the diaphragm which will cause the valve stem to move downward carrying the right hand end of lever K downward in a movement tending to close the pilot valve.

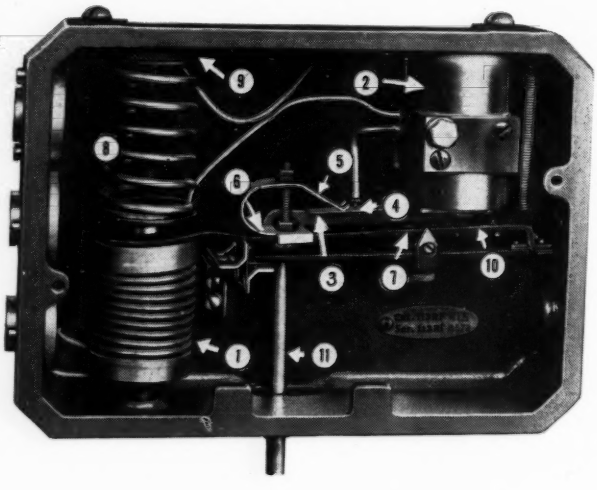
This movement continues until equilibrium is again established with the pilot valve still in a throttling position but with the valve stem of the control valve in a position in direct correspondence with the pressure of the air from the controller acting on bellows D.

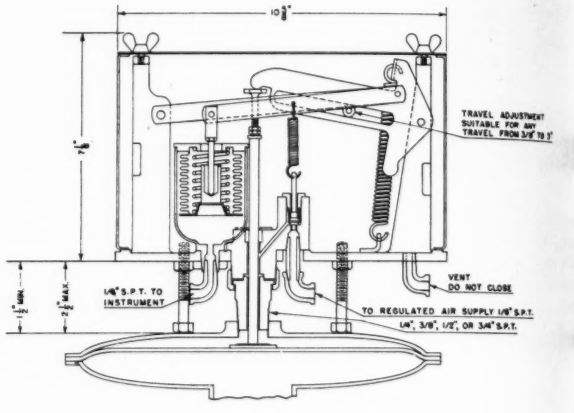
Thus it will be seen that for each value of the controlled air pressure (air from the control instrument) there is a corresponding position of the control valve stem.

Fig. 6. Foxboro Valvactor. Assume a decrease in the controller output pressure. Bellows (3) will contract, pulling the actuating lever (1) to the left uncovering the nozzle (5). This bleeds air from the bellows (8), seating the relay to vent air from the valve motor. The motor air pressure will decrease until the valve stem is sufficiently raised to rotate the actuating lever (1), and therefore the flapper, back to a position of tangency just covering the nozzle (5).

Hence, for any given air pressure in the Valvactor bellows, there is but one position of the valve stem, giving a positive relation between instrument output air pressure and valve position. For the slightest increase in output air pressure, full 17 psi air pressure is available on the motor to insure correct mechanical positioning of the valve stem.






TRAVEL ADJUSTMENT SUITABLE FOR ANY TRAVEL FROM 3/8" TO 1"
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1/4" S.P.T. TO INSTRUMENT
TO REGULATED AIR SUPPLY 1/4" S.P.T. 1/4", 3/8", 1/2", OR 3/4" S.P.T.

Fig. 7. Taylor Precisor. Mounting on the diaphragm valve it will operate, the positioner consists primarily of a metal bellows (1) and a low-leak relay air valve (2). The bellows receives the output air pressure of the controlling instrument. The relay air valve controls an auxiliary 20-psi air supply which inflates the diaphragm valve motor. Precision valve stem positioning is accomplished by two influences on the relay air valve.

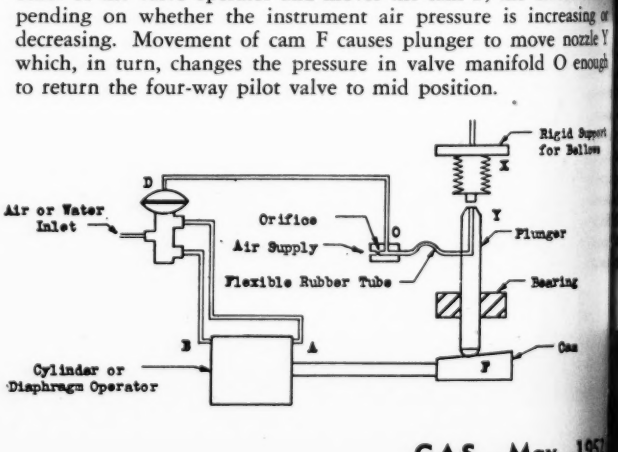
First, the bellows (1) responds linearly to output air pressure changes from the controlling instrument. Bellows expansion or contraction actuates the relay air valve (2), (through frictionless levers), by changing the space relation between its baffle (3) and nozzle (4). A variation in this distance of .002 in. is sufficient to produce a full valve stroke. Used with any size diaphragm motor, Precisor stability is accomplished by the adjustment of foot (5).

Second, a rod (11), attached to the ball-jointed takeoff on the stem of the valve, transmits valve stem movement to a lever (6) in the Precisor case. This lever strikes an adjustable pivot (7) to further affect the space relation between relay air valve baffle and nozzle.

Precisor action is therefore definitely linear. The relay air valve is first actuated by a change in controlling instrument output. Immediately thereafter it is further affected by valve stem movement *or lack of movement,* in which case any part of the full 20-psi Precisor air supply becomes available for overcoming the friction and for positioning the valve exactly according to controller demands.

Fig. 8. Brown Valve Positioner. The air from the instrument positions a bellows and through a differential lever system moves the pilot valve. Air supply pressure is then admitted to or expelled from the diaphragm until the valve stem has moved to balance the pilot valve. Therefore, the valve is definitely positioned regardless of friction or other unfavorable conditions.

Fig. 9. DeZurik Valve Positioner. Air from instrument changes (i.e., increases or decreases) and bellows X moves toward or away from nozzle Y. This causes pressure to increase or decrease in air manifold O which causes four-way pilot valve D to move from its mid position which, in turn, applies pressure to one side or the other of the valve operator and moves the cam F, the direction depending on whether the instrument air pressure is increasing or decreasing. Movement of cam F causes plunger to move nozzle Y which, in turn, changes the pressure in valve manifold O enough to return the four-way pilot valve to mid position.



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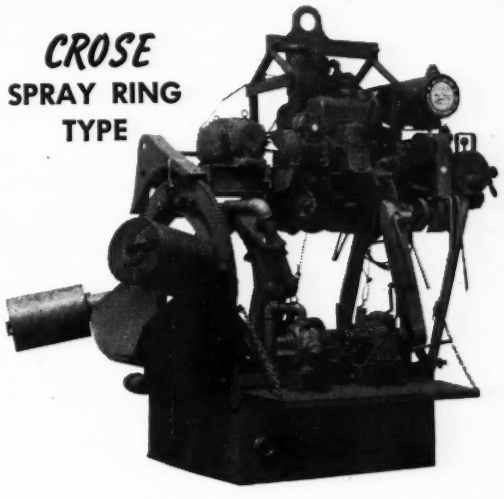

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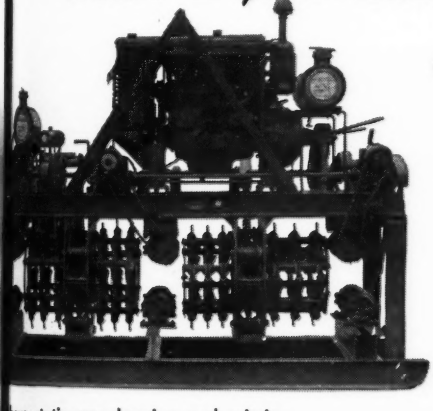

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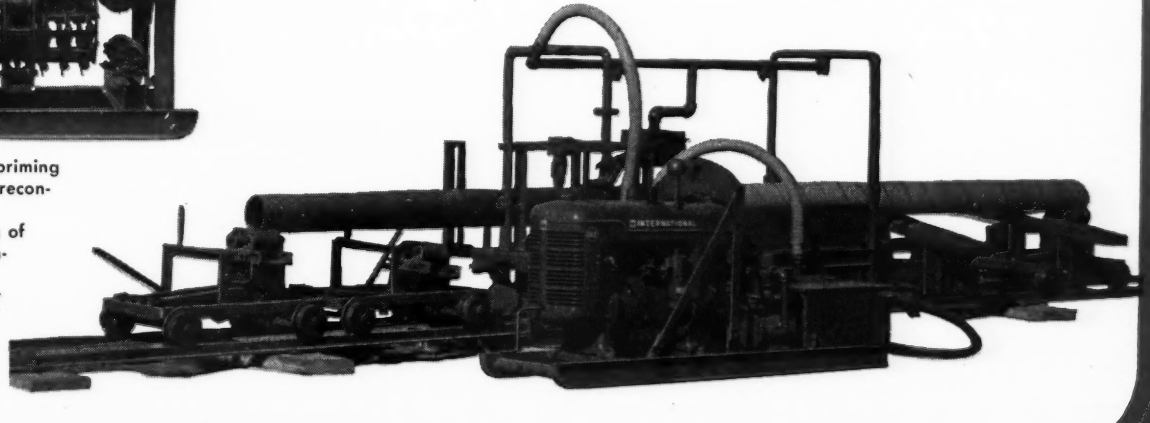

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VALVE POSITIONERS: TYPE 2.

Converts controller output to a force which can be compared to another force set up by movement of the valve stem.

Fig. 10. Fisher Positrol. This instrument employs the force balance principle in which the instrument or primary controller air pressure applied on the bellows assembly is balanced by a spring under compression. The necessary compression on the spring to balance the instrument pressure on the bellows is supplied by the movement of the control valve stem transmitted through a compound lever system.

In the schematic drawing of the Positrol, it can be seen that an increase in instrument pressure will overcome the spring force so that the bellows assembly will move to the left and open the supply valve. Operating medium supply pressure at 20 psi then enters the inside of both bellows and out through the passage to the control valve diaphragm. The pressure sent to the diaphragm will continue to increase until the downward movement of the main valve stem applies enough force on balance spring to overcome the increased pressure from the instrument so as to return bellows assembly back to its original position and close supply valve.

A decrease in instrument pressure will cause bellows assembly to move to the right and open the exhaust valve, bleeding pressure off of the control valve diaphragm. The valve stem will move upward and by means of the linkage and lever arms, reduce the compression on the balance spring until the spring compression is again equal to the bellows force.

Thus the Positrol provides the necessary force to assure accurate positioning of the valve so that at all times, for every unit change in instrument pressure, there is one and only one corresponding position of the valve stem.

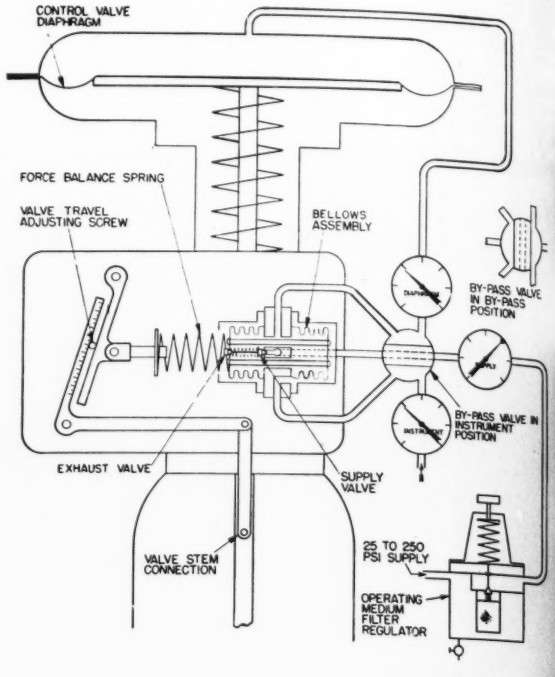


Fig. 11. Bailey Positioner. This instrument consists, essentially, of two opposing forces balanced one against the other to maintain a control valve position depending upon the magnitude of the forces.

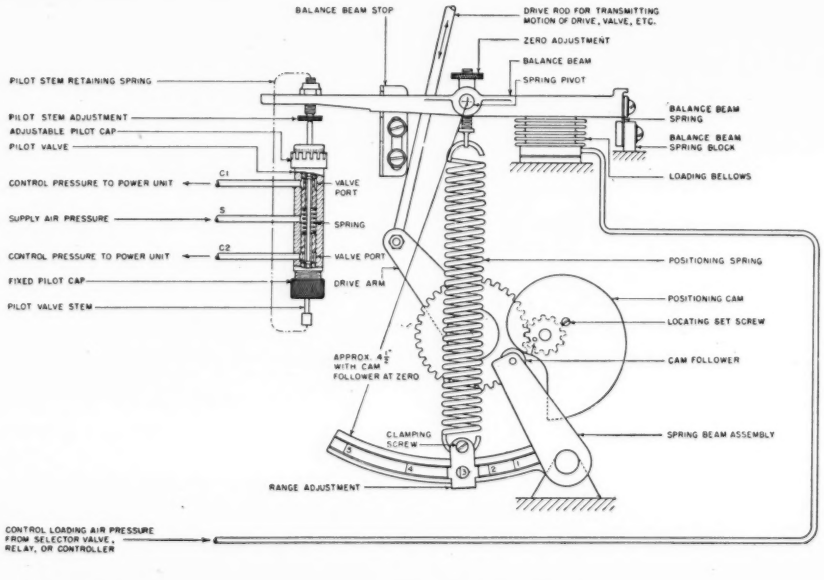
With reference to the drawing, when the positioner is at balance, the force exerted upward on the balance beam by the loading bellows is equalled by the force exerted downward by the positioning spring. The force exerted by the loading bellows depends upon the control loading pressure to the bellows. The control loading pressure is that which has been established by the control system in accordance with demand for the controlled medium.

The force exerted by the positioning spring depends upon the position of the valve stem (which, actually, is the position of the inner valve) and the shape of the positioning cam. The valve stem is connected to the positioner drive arm by means of the drive rod so that, for every position of the valve stem, the drive arm takes a corresponding position.

As shown, the drive arm is geared to the positioning cam. The cam moves the spring beam assembly to give more or less tension to the positioning spring. The tension of the spring, then, depends on the position of the drive arm and, thereby, the position of the inner valve. The positioning cam enters into determining the spring tension in that its shape may be whatever is required to give a desired characteristic of inner valve position versus control loading pressure.

With the forces exerted by the loading bellows and positioning spring at balance, the balance beam holds the pilot valve stem in that position which will hold the control valve position constant.

When the control system indicates, by a change in control loading pressure, that the control valve should be repositioned further open or further closed, the force exerted on the balance beam by the loading bellows is increased or decreased. This will raise or lower the balance beam and pilot valve stem to increase or decrease the control pressure to the diaphragm motor. As the control valve stem is moved by the diaphragm motor, the positioning spring tension is increased or decreased until the forces exerted by the bellows and spring are at balance again, the pilot valve stem assumes a new position, and the motion of the control valve has stopped in its new position.



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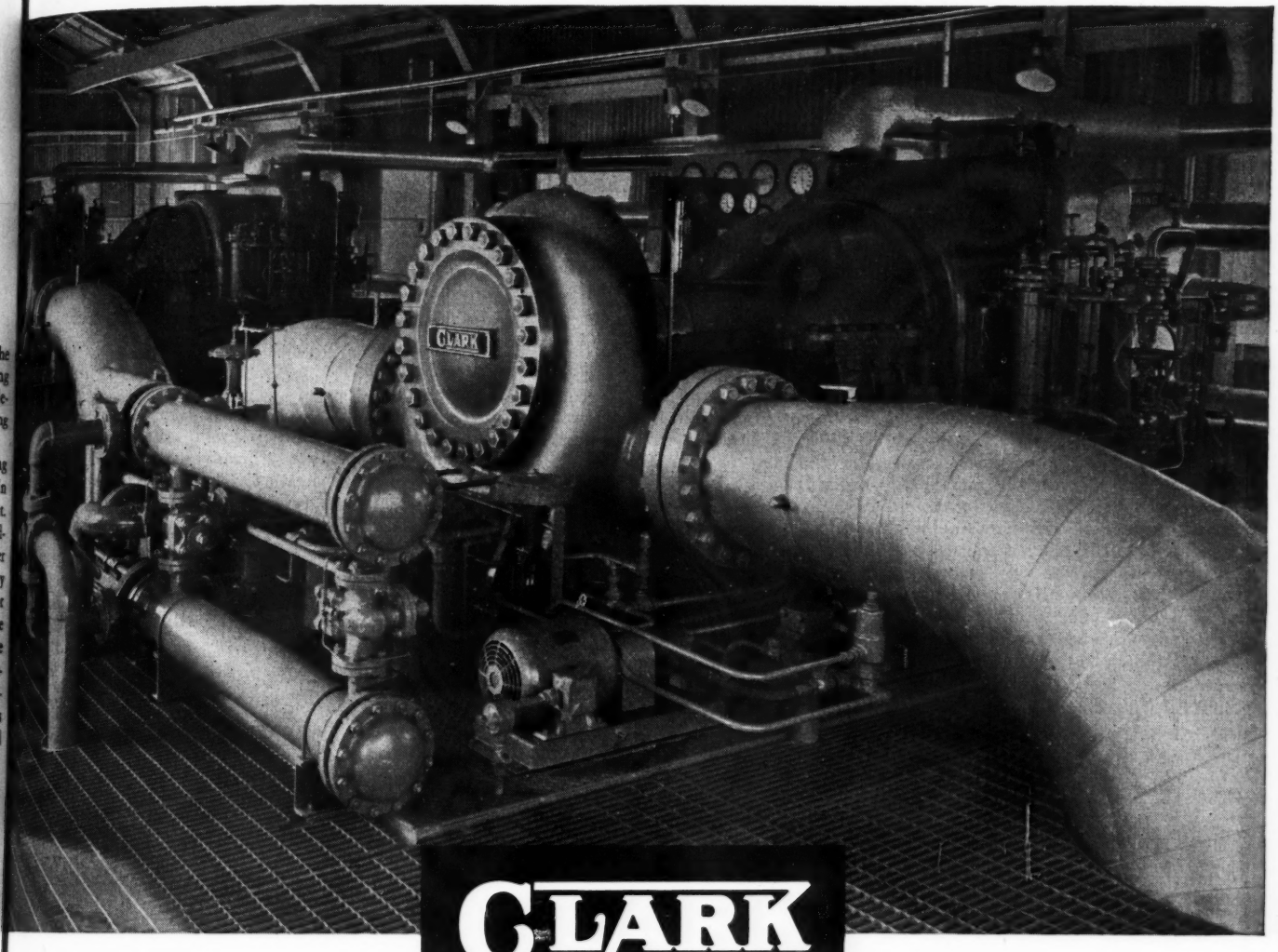

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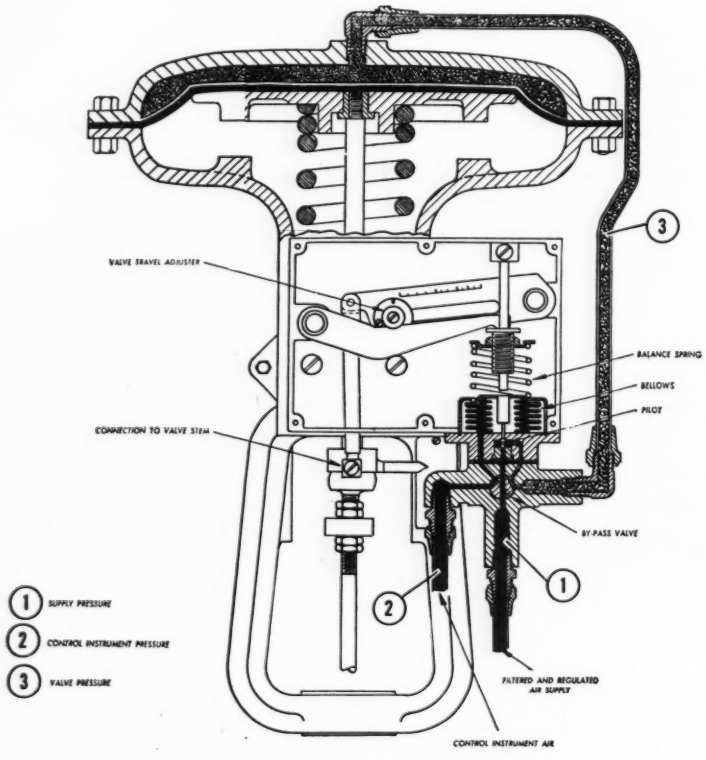

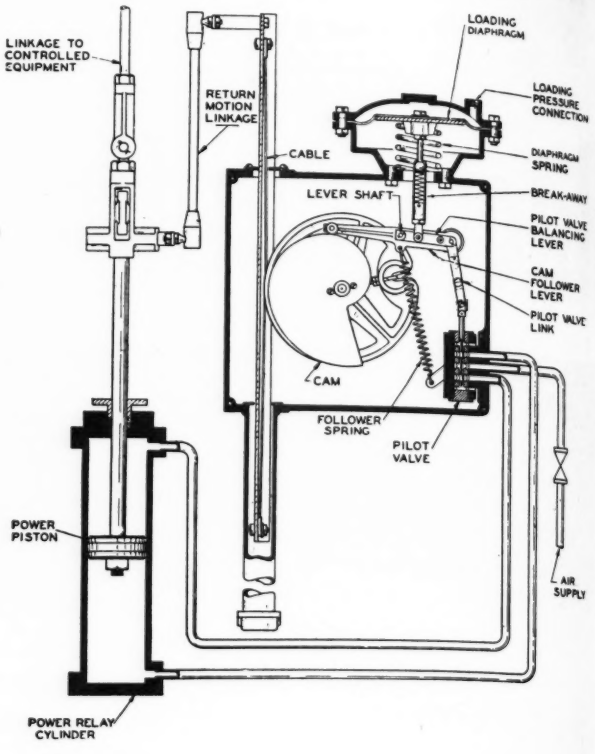

Fig. 12. Moore Valve Positioner. This instrument employs the principle of balanced operation, by spring loading the bellows unit (from the actual motion of the valve stem) to the same force as that exerted by the control-instrument air pressure.

A rise or fall of control-instrument air pressure moves the bellows and operates the air pilot. Supply air is admitted to the diaphragm-motor chamber, or exhausted past the upper pilot stem, to the atmosphere. As the valve moves, the balance-spring load is changed. This action brings the bellows and pilot back to their original positions, thus restoring the balance between the spring loading and the control-instrument pressure.

Bellows characteristics do not affect the calibration, because the bellows remain in virtually the same position at all points of balance. The arrangement of the levers compensates for angularity errors. A linear relationship exists between the control-instrument pressure and the actual motion of the valve.

The bellows and air pilot are a self-contained unit, without elements which would introduce friction and cause errors. Any friction in the lever bearings is on the valve side and, therefore, does not influence the performance of the positioner.

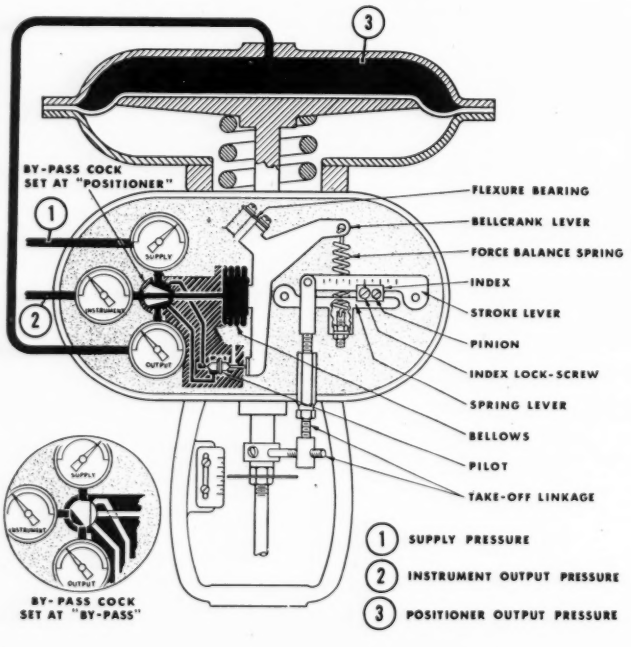

Fig. 13. Republic Operator. With zero pressure on the loading diaphragm the power piston is at the top of its stroke. Application of pressure on the loading diaphragm causes it to move downward against the compression of the diaphragm spring. The pilot valve balancing lever is pinned at its left end to the cam follower lever.

Since this pivot point is held stationary at the beginning of the cycle, the right hand end of the balancing lever is moved downward. This moves the pilot valve connecting link and results in a movement of the pilot valve. The pilot valve is connected to a supply of air under pressure.

When the valve is moved from its neutral or mid-position, the pressure is increased on one end of the power piston and decreased on the opposite end. This produces a movement of the power piston. As indicated in the diagram, the power piston will move downward and produce a counter-clockwise rotation of the circular cable pulley which holds the shaped cam plate.

The cam roller is held against the edge of the cam by a spring and therefore follows the shape of the cam so that the cam lever turns on its supporting shaft to reset the pilot valve to neutral.

A decrease in pressure on the loading diaphragm causes a reversal of all the movements described above. The cam may be shaped to produce any desired relation between loading pressure and power piston position.

Fig. 14. Masonielan Valve Positioner. With the by-pass set for "positioner," the instrument output pressure is applied to the bellows. When this pressure is increased, the bellows rotates the bellcrank lever on the frictionless flexure bearing, causing the pilot to increase the positioner output pressure to the control valve.

The resultant valve stem motion is transmitted through the take-off linkage and positioner levers to the force balance spring, loading it until the spring tension on the bellcrank lever balances the opposing force of the bellows. When these two forces are in balance, the system is in equilibrium with the pilot throttling the output pressure to maintain the equilibrium as instrument output pressures change.

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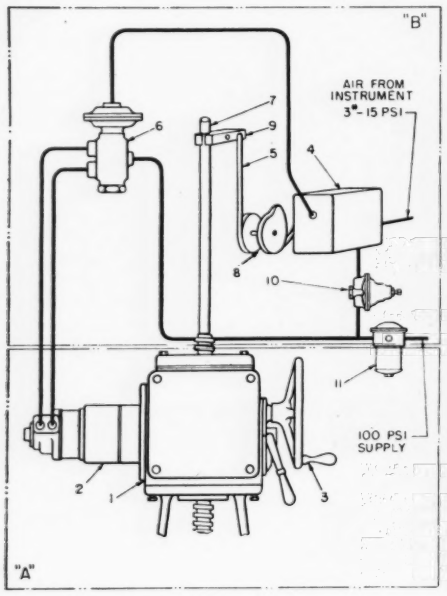
OTHER VALVE POSITIONER DESIGNS



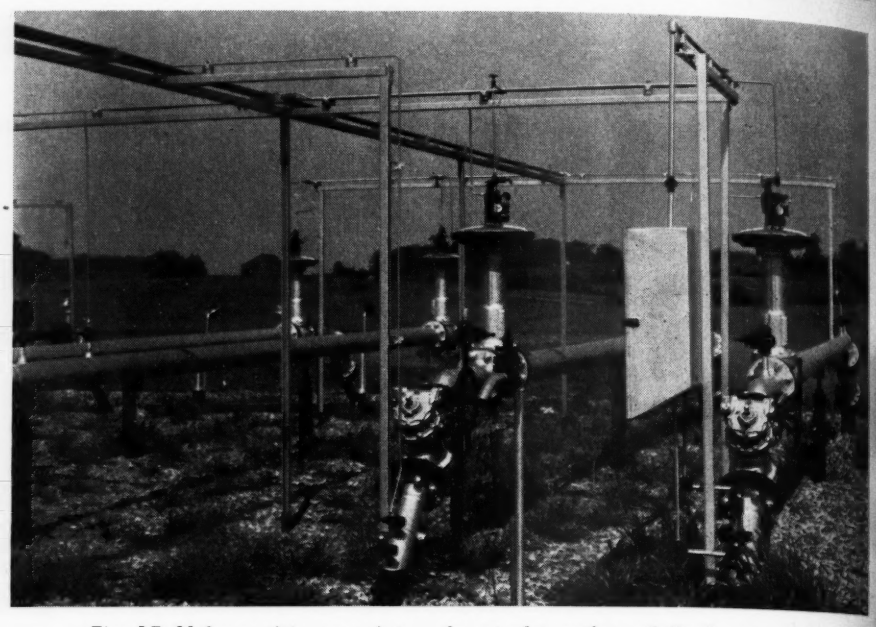


Fig. 15. Valve positioner as integral part of top plate of diaphragm case.

Fig. 16. Conoflow Rotomotor. This instrument has two principal components, a gear drive unit (A) and the Conotrol positioning unit (B).

The gear drive unit is of the worm and wheel type, tailored to fit the required thrust and stem speed of the specific job. All gears are housed in a grease packed case (1) to which is attached the driving motor (2) and the declutching handwheel (3).

The Conotrol positioning unit consists of a cam-type pneumatic position-detecting mechanism (4), fitted with a stainless steel tape (5) and a special four-way auxiliary valve (6), both of which are suitably mounted inside a weather-proof steel housing on top of the gear drive unit. Valve stem position is detected by screwing an extension stem (7) into the main valve stem and attaching thereto one end of the stainless steel tape (5) by means of a block (9).

Air supply pressure to the positioner is regulated by a reducing valve (10). The main operating air supply, which can be at any air pressure from 70 to 100 psi, is led to the auxiliary valve through a suitable filter (11) to eliminate any chance for scale accumulation in either the auxiliary valve or the driving motor.

In normal operation, output air pressure from the primary control instrument is impressed on the position detecting mechanism (4). Output of mechanism (4) goes to the operating head of the auxiliary valve. Auxiliary valve (6) is designed to direct the flow of motor operating air to either forward or reverse ports of the motor, in accordance with the dictates of the primary control instrument.

When the controller has satisfied a condition, the auxiliary valve returns to midposition, both forward and reverse ports are closed, and the driving motor remains motionless.

Porting in the auxiliary valve is tailored to fit the air consumption requirements of the various sizes of driving motors available for specific Rotomotor gear drive units in order to keep air consumption at a minimum. Sensitivity and stability of the instrument are, however, completely independent of the sizing of these ports.

Porting is designed to throw full air pressure on the motor the instant there is the slightest deviation from the desired control point. In this respect the Rotomotor is quite different from diaphragm and cylinder operators, where the amount of applied power in the initial stages of repositioning is proportional to the amount of deviation.

(Continued from p. 130)

other very different valve opening characteristic. With this instrument a valve may be opened rapidly through a portion of its travel; or, a semblance of the percentage characteristic may be obtained with a linear plug. This type of positioner may be used to control the opening of a gate valve or plug cock to give a characteristic flow curve suitable for process control. This application has considerable advantage in maintaining the good shutoff characteristics of the cock with the addition of good flow characteristics.

The use of the single seated valve, with its attendant advantages for process control, has caused us to consider methods of positioning the valve stem by other means than with the spring loaded diaphragm. The springless diaphragm motor and the pneumatic cylinder are products of the re-examination of the problem. One type is shown in *Fig. 17* and pictured in *Fig. 18.* It is not advisable in this article to cover the phases of this advance in design although this approach to gas control must receive serious consideration.

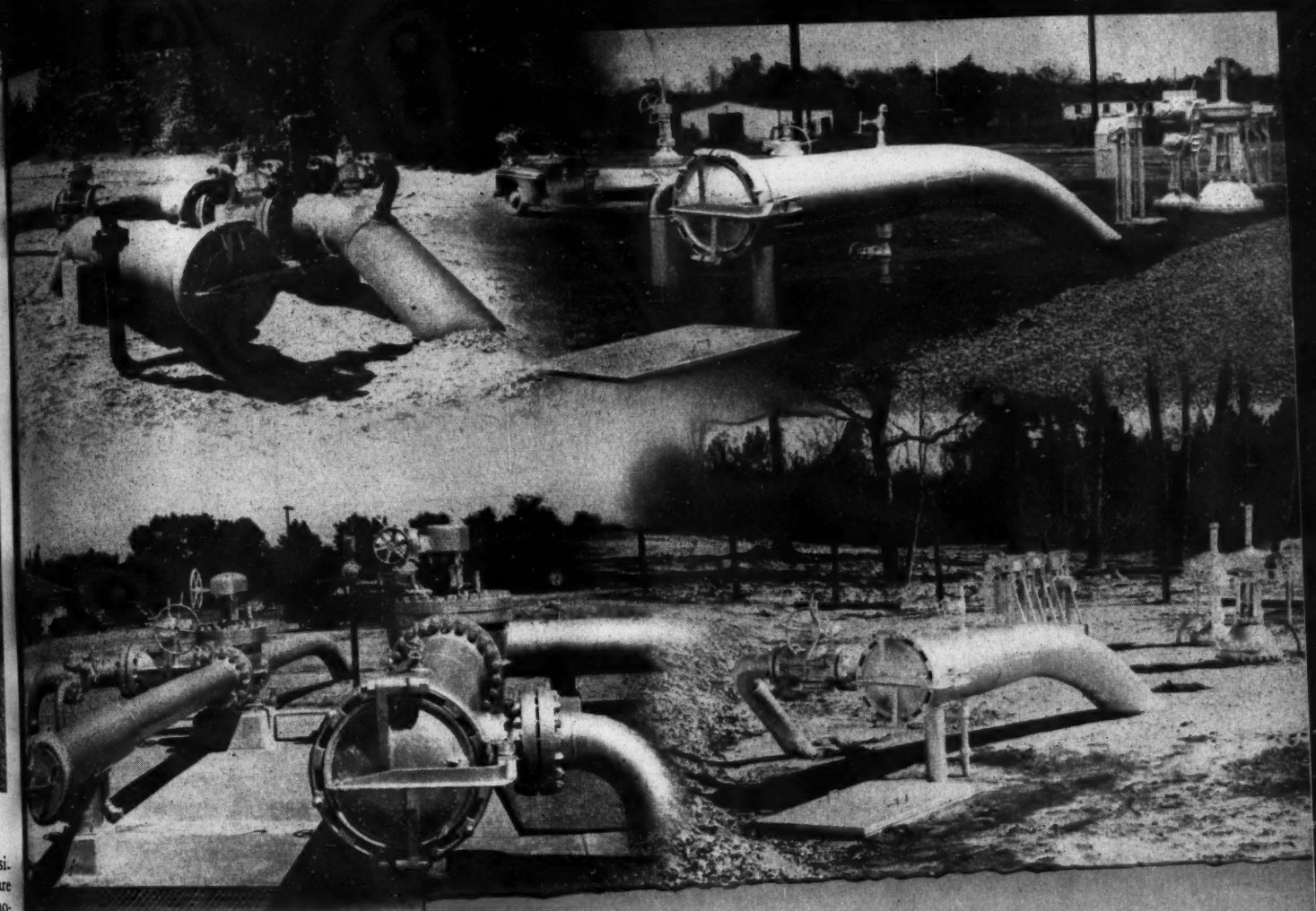
Positioner Required

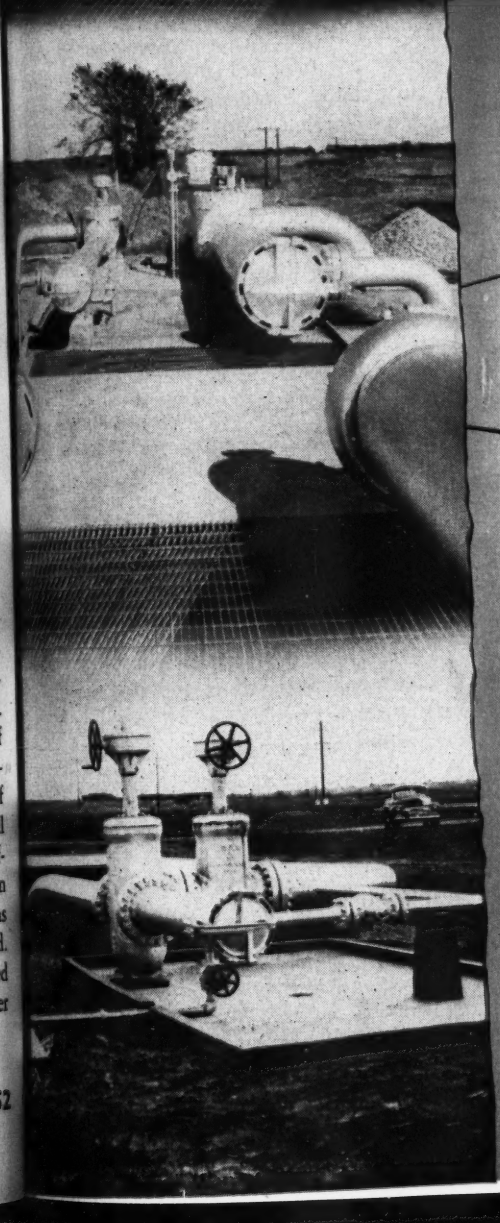
It is, nevertheless, necessary to include these pieces of equipment in the discussion, as the springless diaphragm motor and the pneumatic cylinder require a pneumatic valve positioner for their operation. These valve operators position the valve by creating a difference in pressure between the opposite sides of the diaphragm or piston of correct magnitude to accurately position the valve. The advent of the positioner makes it possible to do this quite readily.

The force used to oppose the controlled air on the diaphragm may be opposed by a constant air force on the opposite side of a piston or diaphragm. These forces may be greatly in excess of the pressures normally used for diaphragm motor valves. The addition of a reversing relay to the system gives still more range of power by creating the differential by decreasing the pressure on one side of the diaphragm or piston as the pressure on the other side is increased.

A new instrument has been introduced recently which combines the positioner

(Continued on p. 144)





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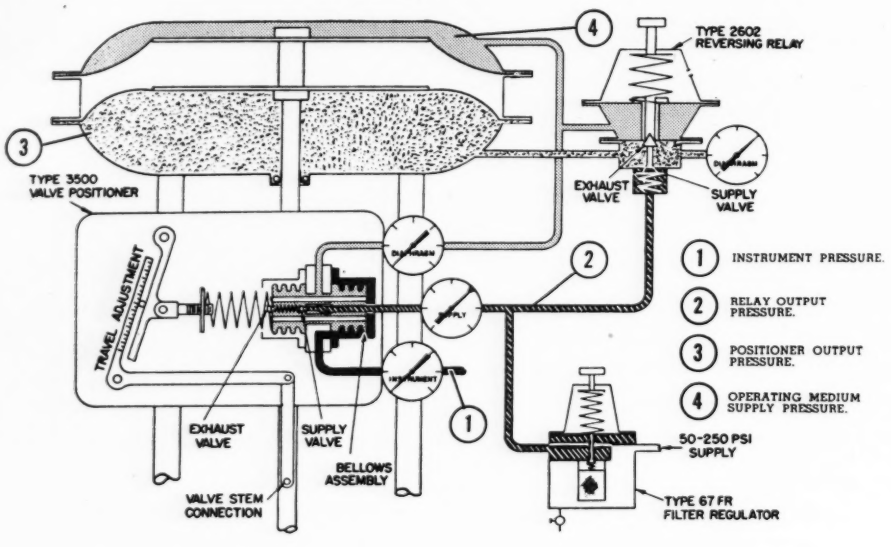


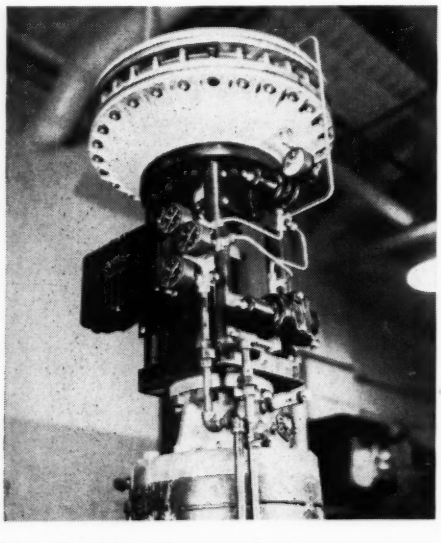
Fig. 17. Fisher Positrol. Supply pressure for the Positrol and the reversing relay is filtered and reduced by the Type 67FR combination filter-regulator to 30 lb. At all times, the sum of the top and bottom diaphragm pressure of the main valve will be equal to the supply pressure, that is, 30 lb. The loading on each diaphragm will, of course, depend upon the valve position necessary to satisfy the instrument's demand.

With the two diaphragms in dynamic balance, let us now assume an increase in instrument pressure. An instrument pressure increase moves the bellows assembly of the Positrol to the left and opens supply valve to admit operating medium supply pressure to the top diaphragm of main valve.

This supply pressure is also sent to the chamber between the diaphragms of the Type 2602 reversing relay. Since the area of the top diaphragm of the reversing relay is twice the lower diaphragm, the assembly moves upward and opens the exhaust valve so as to bleed the lower diaphragm of the main valve an amount equivalent to the pressure increase applied to the top main valve diaphragm.

The unbalance of forces on the two main valve diaphragms results in a downward movement of the valve stem and a repositioning of the main inner valve. At the same time, this downward stem movement causes additional force to be applied on the balance spring of the Positrol so as to bring the bellows assembly back into balance and close the supply valve.

Conversely, a decrease in instrument pressure would cause the exhaust valve of the Positrol to open and bleed pressure off of top diaphragm. The loss in diaphragm pressure permits the spring in the reversing relay to push the diaphragm assembly downward, open the supply valve, and load the lower main valve diaphragm. Valve stem then moves upward to the valve position called for by the instrument.



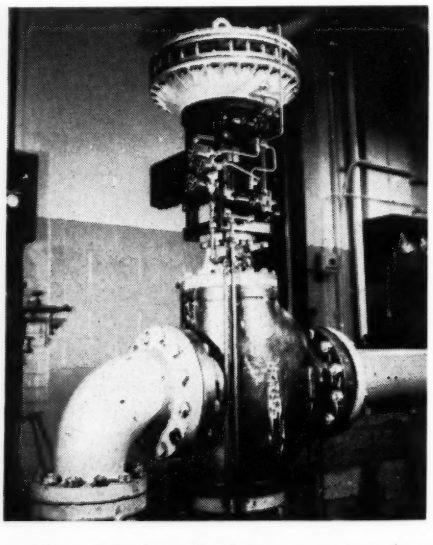


Fig. 18. Fisher Governors' valve positioner operating springless diaphragm motor valve.

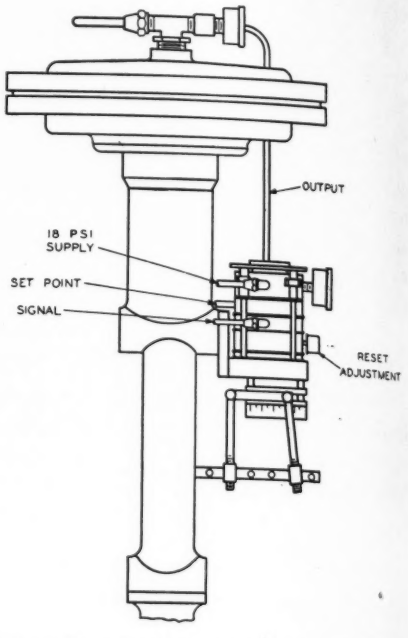


Fig. 19. American Meter's combination valve positioner and controller.

(Continued from p. 142)

with a stack controller mounted on the valve as shown in *Fig. 19*. The controller is operated from the output of a transmitter so that the control valve may be operating on flow, pressure, or any other variable that may be measured and the measurement transmitted. The set point is also transmitted so that control is accomplished by balancing these two pressures.

Positioned By Unbalance

The relay valve is positioned by the unbalance in these pressures. The same relay is acted upon by the valve position air pressure which is retarded by the reset valve. Control is accomplished when these signals are in balance. This controller offers many possibilities for simplifying certain installations.

As was stated in Part I, the pneumatic valve positioner offers the gadgeteer a paradise of possibilities. The following examples have been selected to emphasize the possibilities. The use of the valve positioner as a motion transmitter has become so prevalent that some companies furnish the equipment adapted for this application. *Fig. 20* shows how the pilot is used to supply an output relative to the spring force caused by the motion to be transmitted.

(Continued on p. 147)

(Continued from p. 144)

An early application of this type consisted of a contact plate to sense the top of the catalyst bed in the catalyst chamber of a catalytic cracker. A change in level of possibly 10 ft was translated through a worm gear to another vertical motion small enough to simulate the travel of a valve stem. This was connected to the deflection beam of a deflection type positioner. The instrument was calibrated to obtain a 3- to 15-lb output with movement of the plate through its entire range.

Two Controllers

The instrument engineer is continually confronted with systems which can be operated to best advantage with two controllers. One instrument controls on one variable until the value of another variable reaches a predetermined limit at which time the second controller takes over. Some of these systems can be handled by using the controlled output pressure of one controller as the supply pressure of the second controller. Some may be handled with a limit controller which allows the variables to fluctuate until they reach predetermined limits.

One particular installation is recalled in which it was desirable to hold a constant pressure on a gas line until the flow reached a maximum. At this point the flow, although limited, was to be kept at this limit if consumption warranted. Considerable economy was possible in using two controllers, but only one diaphragm control valve. The valve positioner was connected as shown in *Fig. 21*, to be used as a snap acting relay to operate a three-way pilot for selection of the controller, which was to operate the gas valve.

If the end of the deflection beam normally connected to the valve stem is held rigid, the range spring may be set so that at any desired point, the bellows will operate the pilot with a snap action. This snap-acting gadget may be used to advantage on the output of any pneumatic controller to sound alarms or put another instrument into service.

Large Differentials

The use of a valve positioner should be a serious consideration for a great many gas distribution or transmission problems. The tremendous quantities of gas which must be handled in large city gate stations require large valves, and the high transmission line pressures cause large differentials which are beyond the ability of the diaphragm to handle by itself.

The present trend toward the use of springless diaphragm motors and pneumatic pistons for service requiring great power to minimize vibration or properly position a large valve requires the use of a positioner. This is also true of the increasing popularity of single seated valves. The versatility of this "gadget" to fit into many odd services offers a challenge to the instrument man.

The conclusion must be drawn that the engineer dealing with gas transmission and distribution control and instrumentation should not lose sight of the variety of applications which may be improved by the use of a valve positioner.

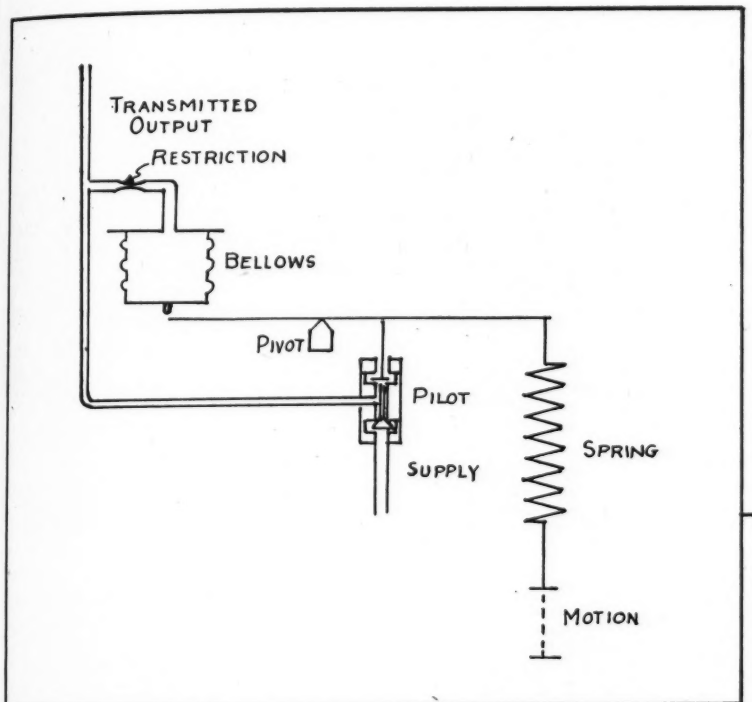


Fig. 20. Valve positioner as motion transmitter.

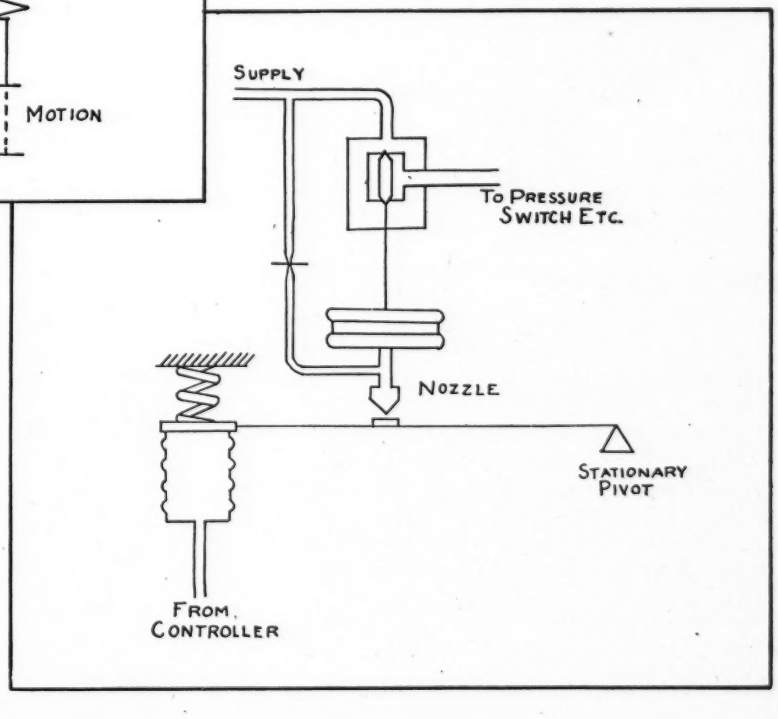
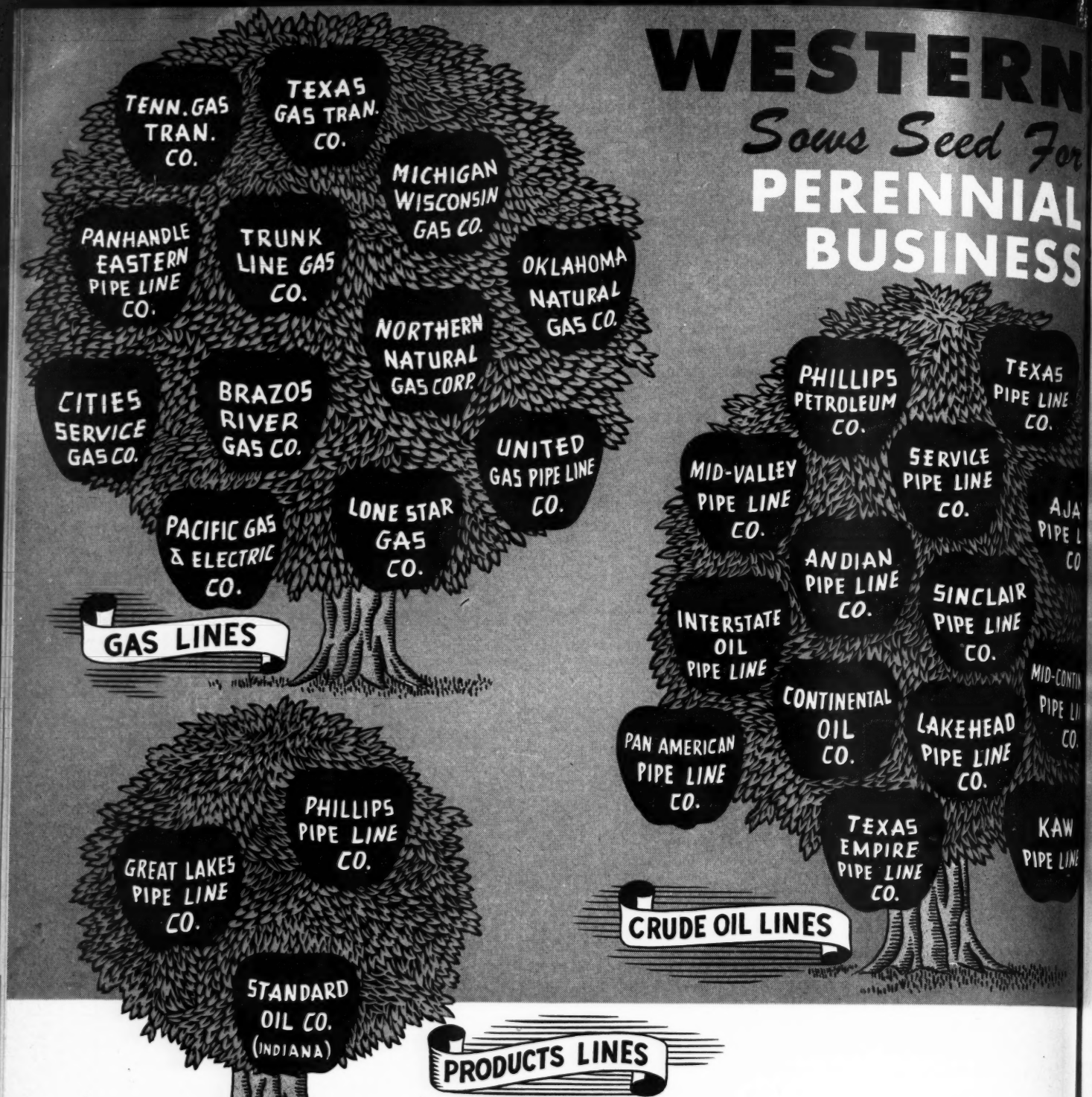


Fig. 21. Valve positioner used as snap acting relay.



RECOGNIZE THIS AD?

We ran it a few months ago, but at that time the "fruit" was red. Yes, this was the Western Apple Orchard . . . grown from "seeds sown for perennial business". We're proud to say the orchard is still growing, but we've taken a good deal of kidding about our horticulture. Some of our business associates seem to think that our apples are really . . . plums! Okay, we'll go along with that! Look over the "plums" of Western's Pipe Line Business . . . we're proud to have been selected to supply the heat exchangers in the vast expansions of these gas, crude and product lines.

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Brock No. 2, largest producer to date, blows in as Saskatchewan's oil and gas boom gets under way promising a new gas source that may some day rival Alberta's resources in size.

IN natural gas development, the north is beginning to take some of the play away from the south. Even the eyes of Texas are on the lands that abut the Canadian border.

While the lion's share of attention has centered upon Alberta in this new era of exploration, the largely untried area defined as the Williston basin, extending through eastern Montana, North Dakota, and the province of Saskatchewan, is slowly shaping up as the continent's newest natural resources frontier.

From the broad view, cubic foot for cubic foot, the sector lying north of the international boundary may emerge as the more important of the two. Politically, a great wealth of gas reserves in this region would relieve the pressure in other areas. Alberta might conceivably yield a bit in her export policies and the demand in Ontario might be supplied with less difficulty than seems apparent today. Problems of international reciprocity might thereby find an easy solution.

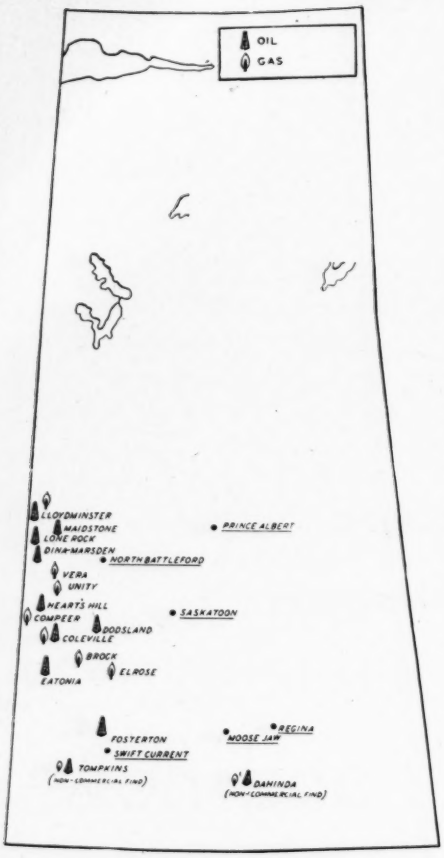
A real boom in Saskatchewan, which it is claimed is in the making, would be geographically beneficial. Today, the importance of a single producing sector is no longer relatively local. It's not even nationwide; it's international. So what is happening in Saskatchewan right now is a matter of very direct concern to the natural gas industry of the entire U.S.—even though not one single cubic foot of its gas might ever leave Canada.

How big is the boom?

"Saskatchewan's present development," declares D. H. F. Black, director of the provincial industrial development office, "is featured by a gigantic program of oil and natural gas exploration and development, the equal of which in terms of speed and acceleration has never before been experienced in the western hemisphere.

"Although some limited activity took place prior to 1949, this development has been telescoped into the last 2½ to 3 years, during which time the province has moved from the position of being a relative non-entity in the oil industry to the rank of fifth on the North American continent, in terms of geophysical activity, being exceeded only by Texas, Alberta, Oklahoma, and Louisiana."

Results of this intensive search for reserves are manifest in the API report of proved reserves for 1951, which shows a 100% increase in crude oil reserves in the single year. True, the year-end total is not particularly impressive—21



Tiny oil derricks and gas jets indicate areas in the province in which oil and gas have been discovered. Although actual finds have been limited to the southwest, discoveries to the north and east are optimistically anticipated.

million barrels as compared with Alberta's 1.3 billion; but, despite widespread search for oil in the latter province, reserves there increased less than 13% in the same year.

The big boom only got started in 1949. Some indication of its scope is seen in the fact that, although oilmen have been searching for oil ever since Saskatchewan became a province, more wells have been drilled in the past two years than in all previous years lumped together. In 1948, only $200,000 was spent in exploration, but in 1949 $2 million was expended, and in the two succeeding years activity cost $8 million and $18 million, respectively. Tentative estimates of $30 million in developmental costs for 1952 are being revised upward to as much as $50 million since discovery of oil at Fosterton and natural gas at Brock.

Leduc Find Spurred Search

Alberta's Leduc find in 1947 stirred up a contagion of excitement that spilled over into neighboring provinces; this bonanza provided the spark that set Saskatchewan ablaze with optimism.

For the first year or two, activity was largely geophysical and it wasn't until the spring of 1950 that the first oil strike was made, in a well in the Kerrobert area near Heart's Hill. But neither oil nor natural gas in quantity began to come in until early last year. This marked the beginning of the third phase of natural gas exploration—actual development. Isolated discoveries (phase 1) of natural gas had been made at Lloydminster, Kamsack, and Unity before the second phase, extensive geophysical work, began. Finally, in 1951, major natural gas discoveries launched the present programs of proving up the fields.

The first really important natural gas finds were in the Brock-Coleville-Dodsland triangle (see map) in the western part of the province. The discovery well, Royalite-Albercan-Coleville No. 1, came in last August. Since then, further strikes have been made at Coleville which already give clear promise of proving up reserves exceeding those serving the town of Lloydminster. Shortly after the Coleville find, gas was struck at Brock, 300 miles to the southeast.

Most Southerly Field

Subsequently, the Husky-Phillips team which made the Brock discovery undertook to prove up the field. Their first follow-up well was a major success. At Dodsland, 20 miles east of Coleville, the Superior Oil Co. obtained a gas showing in one well and is completing a second.

Sohio opened 1952 auspiciously with a discovery well at Elrose, 35 miles southeast of Brock. This is the most southerly of any gas fields and finds in either Saskatchewan or Alberta.

As an indication of the scope of some of these finds: Royalite-Albercan-Coleville No. 1 tested 4.09 MMcf per day on drill stem test, R-A-C No. 5 tested 7.5 MMcf. On open flow, Husky-Phillips-Brock No. 1 tested 21 MMcf while No. 2 tested 40 MMcf; on drill stem test, Elrose No. 1 tested 4 MMcf.

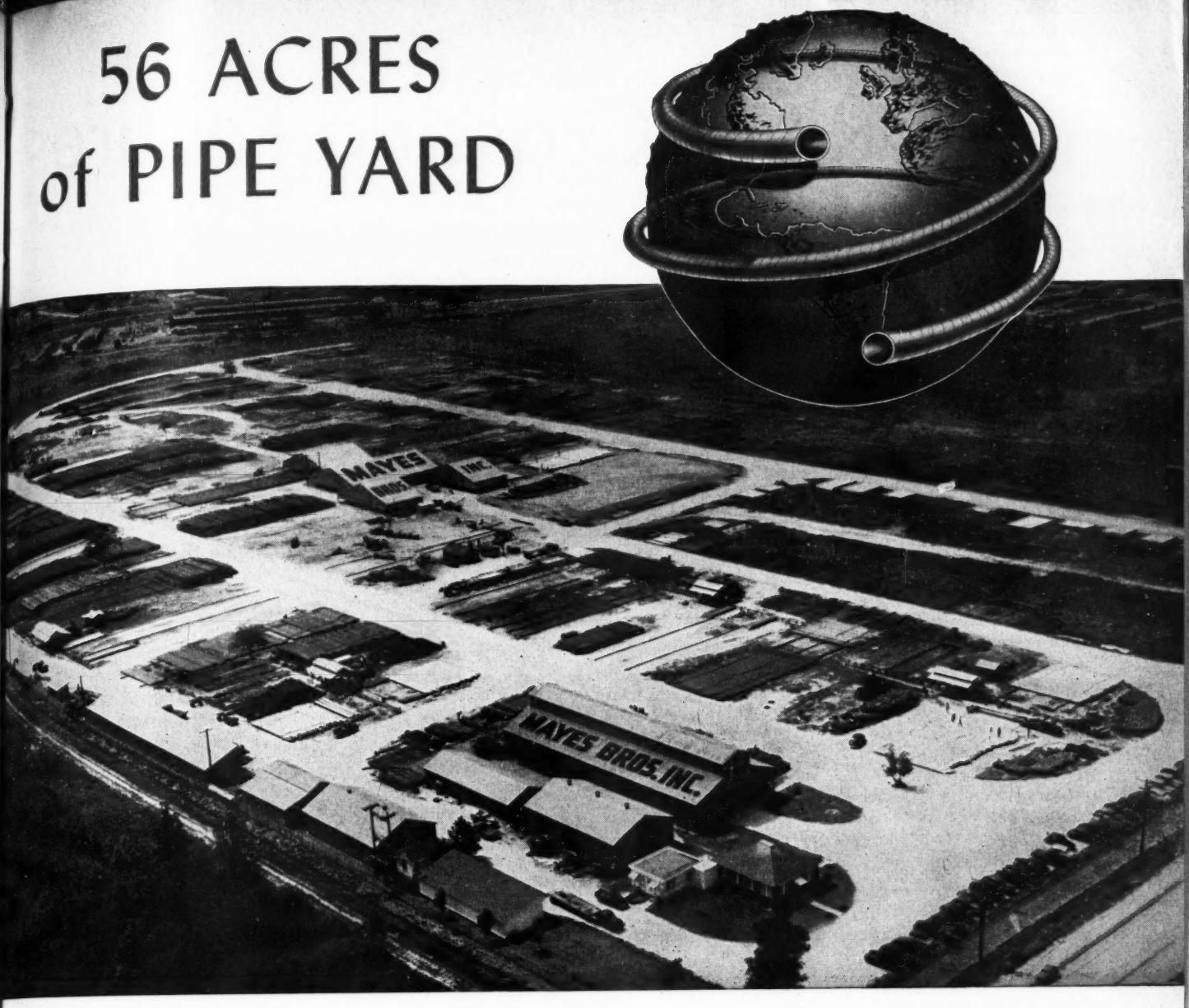
Home Market Adequate

The province won't be looking past its borders for markets for a long time to come. Right now it's a question of piping the gas to cities and industry, and of attracting new factories to the area. Lloydminster, Kamsack, and Unity are now served natural gas, and it is at the latter point that the first tangible benefit of industrial gas has been felt. A $1 million salt plant was erected there by the Prairie Salt Co. Ltd. when, and only when, sufficient gas reserves to serve it had been proved. The Unity power plant also is using natural gas, and is one of the most economical plants of its type in the province.

Other major industries may get their start now that the boom is on. With extensive deposits of high quality clays in the province, a sizeable ceramics industry is expected to blossom out. Provincial officials say this potential wealth-making business has been holding back only for want of an inexpensive fuel.

Prairie Salt Co.'s $1 million plant recently constructed at Unity. Location of plant hinged upon proving up sufficient gas reserves to serve it. Saskatchewan is banking heavily on the influx of such industries as this in the wake of the boom.

56 ACRES of PIPE YARD



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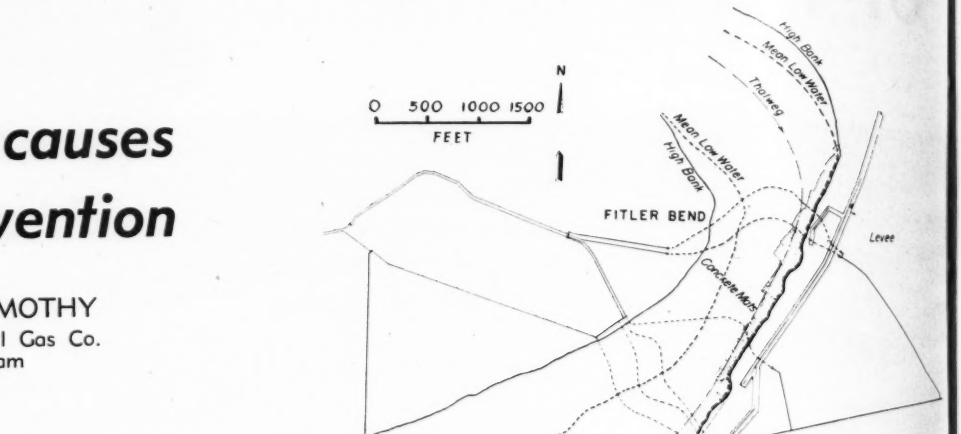
River Crossing Failures

. . . Their causes and prevention

By P. H. TIMOTHY
Southern Natural Gas Co.
Birmingham

Over 20 years, of a total of 26 lines installed at Fitler Bend on the Mississippi river, 20 failed. This article reports the results of a study of these failures and new construction methods which were adopted. Fig. 1, shown here, is a drawing indicating the location of the old crossings (above at right) and the new crossings (below at left).



Analysis of Causes of Breaks

BEGINNING in 1929, a series of multiple pipeline crossings was constructed by Southern Natural Gas Co. at Fitler Bend on the Mississippi river about 30 miles above Vicksburg, Miss. By 1949, a total of 26 lines had been laid at this location and at the present time only four are in service. The 22 abandoned lines include some which had previously broken and been repaired. Following two breaks last March, extensive investigations and studies were undertaken to determine the causes of failure and to design a new crossing to overcome such defects.

The locations of the center lines of these multiple crossings are shown in *Fig. 1.* The pipe sizes are mostly 10¾-in. x ¾-in. Some lines were bowed upstream while others were bowed downstream with curvature more or less uniformly distributed throughout their lengths.

The crossings lie within a two-mile reach on the lower part of Fitler Bend. Along the west bank lies a wide and rapidly accreting bar which is completely submerged only at bank-full stages. The low water line on the west bank has shifted eastward at an average rate of about 150 ft per year during the past 30 years.

The east bank is under heavy attack and revetment in the vicinity of the bight was commenced in 1907. Accelerated recessions below the revetment have attained rates of 300 to 400 ft per year at certain locations. Extreme instability is characteristic of this entire section of the river where banks are more or less continually accreting or receding and bottoms scouring or shoaling.

All known breaks occurred on the east side generally within 600 to 800 ft of the high bank. This places the breaks at the thalweg or in the deepest water where maximum velocities occur. On revetted banks the breaks are approximately at the toe of the articulated concrete mats. These failures are believed due primarily to the following causes:

1. *Scour.* The extent and depth of scour are functions of bottom velocities. At Fitler Bend high velocities and deep scours are concentrated at the thalweg within a few hundred feet of the east bank. The bottom profile is almost flat over the bar on the west side for about three-fourths the width of the river. This gradual slope across the bar suddenly drops at the channel into a deep and narrow V-shaped gorge adjacent to the east bank.

During floods, a pipeline lying at or just below the bottom can readily accommodate itself to the relatively small and uniform scours occurring over the bar where the flow is practically laminar and only minor changes in bottom velocities occur. Shoaling immediately follows on a falling gauge, and as the bar is accreting rapidly the line soon buries itself and generally remains imbedded.

At the thalweg where rapidly rising gauges are accompanied by violent velocity changes and extreme turbulence, scours of 40 to 50 ft in depth may be concentrated in a narrow bottom 600 to 700 ft in width. As the lines were laid

with the customary upstream or downstream catenary with curvature more or less uniformly distributed across the stream, they do not have sufficient slack to conform to the deep scours at this location. Accordingly, the lines are undercut and become suspended for a distance of about 700 ft at the thalweg. Elsewhere on the bottom, the lines generally remain imbedded.

The principal reason for bowing the lines is to provide slack. The futility of uniformly distributing slack over 6000 ft of line is obvious when it is realized that the damaging scour is generally concentrated over only about 700 ft of line. Since the amount of slack available in any portion of line is the difference between the segment and the chord, the slack available in 700 ft of the line as laid is practically nil.

Hence, to be effective, sufficient slack should be made available where the damaging scours occur or are likely to occur and not dissipated throughout the length of the line, the great majority of which remains firmly imbedded.

2. *Hydrodynamic Forces.* Technical publications dealing with river crossings indicate that little weight, if any, has been given to the science of potamology and that evaluation and analysis of the hydrodynamic forces generated by moving waters have not been made. No sound basis has been observed for determining the proper weight of line or so-called negative buoyancy.

Negative buoyancies have been arbitrarily adopted and values as low as 1.2 have been used. One company has adopted 1.3 for all river crossings irrespective of the nature of the stream. Such an arbitrary approach may readily lead to disaster when applied to a stream like the Mississippi river. A negative buoyancy of 2 was used uniformly from header to header on the lines laid at Fitler Bend. As the hydrodynamic forces at this location under conditions of maximum turbulence cause an uplift in excess of the hydrostatic buoyancy, a negative buoyancy of 2 is inadequate to prevent these lines from being projected upward from the bottom in the vicinity of the thalweg.

The lines will by no means rise to the surface. Hydrodynamic uplift varies with depth and hence vanishes at the surface. It is maximum at the thalweg and decreases toward the banks in accordance with variations in velocities. The periodic oscillations in intensity of these dynamic forces combined with the hydrostatic pressures produce sinuous wave motions in an inadequately weighted line with possible increased amplitudes due to resonance. These vibrations cause rapid fatigue or crystallization of the metal and ultimate fracture.

Not only do the lines laid at Fitler Bend not have sufficient weight to withstand the hydrodynamic uplift at the thalweg where maximum turbulence occurs, but they are heavier than necessary at certain other locations. Hence, weight as well as slack should not be distributed uniformly throughout the line but should vary in accordance with the resultant of the dynamic and static uplifts.

3. *Density.* During critical periods of high turbulence, the density of the water at the bottom of the channel due to the suspended and bed load materials is well in excess of that of fresh water upon which negative buoyancies are normally and, therefore, incorrectly based. As bed loads respond instantaneously to changes in velocity, the resultant density varies accordingly.

It is, therefore, maximum at the thalweg and minimum at the bank on the bar side of the channel. The variation in density must also be considered in determining the proper weight of line at any point.

4. *Caving Banks.* The accretion of the bar on the west side of the river tends to restrict the channel, causing increased velocities and erosion of the bank opposite the bar. The receding bank on the east side is in effect being pushed back by the accreting bar on the west side. These receding banks constitute a major hazard to pipelines unless proper precautions are taken.

At Fitler Bend the caving takes place in the upper portion of the bank, which is mostly loam and which sloughs off almost vertically after the lower portion, consisting of saturated sand, flows out from beneath the superimposed mass. The upper part, having a high angle of repose, especially when moist, is supported by arch and cantilever action until it collapses.

As the caving part of the bank lies above the low water plane, the pipelines should be laid in open trenches excavated to approximately low water. Although the trenches will fill during high stages, the material will be mostly sand and relatively free of loam, and will have little tendency to cave. Accordingly, it is not believed that the current and costly practice of excavating banks similar to those at Fitler Bend to considerable depths below low water is justified.

5. *Concrete Revetment.* The Fitler Bend revetment consists of articulated concrete mats laid on the east bank and extending to the thalweg. The purpose of the revetment is to prevent recession and thereby stabilize the bank. Accretion of the bar opposite the revetted bank continues. This encroachment by the bar restricts the cross-section of the channel and causes accelerated bottom velocities, increased scours, and greater depths.

In other words, the bar continues to push against the bank and since the bank cannot recede the bottom gives instead. This action accompanied by increasing depths and velocities normally continues until the bar stops accreting or until the revetment fails, resulting in a possible setback of the levees. The mats conform to the uneven banks and are subjected to maximum turbulence at the toe. As the mat offers greater resistance to scour than the river bottom, deep holes may be cut at the toe of the mat, causing the ends to drop and possibly disintegrate.

A pipeline laid across the concrete mat is suspended between points of contact and at the toe and is thus exposed to everything the river can throw at it. The suspended pipe not only is exposed to the maximum turbulence of the river, but its conformation increases this turbulence. The swaying and vertical motions of the pipe cause impacts and abrasions at the point of contact with the mat.

General Timothy was Gen. Omar Bradley's chief engineer when the latter commanded the American armies during the war in Europe. A graduate of West Point in 1918 and MIT in 1921, he was assistant professor of engineering for several years at the military academy. General Timothy's acquaintance with the Mississippi river began in 1934 when he became the assistant division engineer of the Gulf of Mexico division, with headquarters in New Orleans. After V-E Day he returned to this country as commandant of the Engineer School at Fort Belvoir, Virginia, a command he held until his retirement.

Furthermore, the mats are known to flutter at the toe with extreme turbulence. Hence, we not only have the pipes pounding the mats but we have the mats pounding the pipes. In view of the foregoing, the laying of pipes across concrete mats is not recommended.

Based upon the foregoing analysis, it is concluded that the practice of utilizing a uniformly weighted line as well as a line bowed either up or down stream is unsound. One presupposes a constant turbulence from bank to bank, whereas the other assumes uniformly varying bottom velocities. The two assumptions are inconsistent as well as erroneous as the currents are neither constant nor uniformly varying from bank to bank.

In the selection of a new site within the vicinity of Fitler Bend, not only were existing conditions considered, but far greater importance was attached to a proper evaluation and analysis of the possible changes that could take place within the economic life of the crossing. Considerable time was spent in studying available records of this entire reach of river, including hydrographic and topographic surveys, discharge data, and geological information of the banks and bed of the river.

Composite profiles and shore lines were compiled and studies were made to relate all changes to natural migrations or to artificial causes. Improvements affecting this reach of river such as cutoffs, revetments, and dredging were studied to determine the changes resulting therefrom. Only by means of such background information could a reasonable forecast be made as to future changes which can be anticipated at any given site.

Although conditions are constantly changing in the river, a site was found which has been relatively stable for a number of years and which possible future changes indicate to be less hazardous than other locations. This site is three miles below the old crossings at Fitler Bend (see *Fig. 1*) and one mile above Cottonwood Bar. It is below the crossover of the channel and well out of the Fitler pool. Here the bottom is wide and flat with maximum low water depths of only 15 to 20 ft compared to corresponding depths of about 70 ft in the Fitler pool. The western exits lie on the accreting Fitler Bend bar and the bank at the eastern exits has shown no perceptible change in over 30 years.

Prior to 1937, the main channel ran eastward of Cottonwood Bar and in 1917 willow mats were laid along the east bank which at that time was under attack. To provide better channel easement and to alleviate heavy attack on the west bank below Cottonwood Bar, dredging of a channel westward of the bar was started in 1937.

This artificial shifting and maintenance by annual dredging of the channel to the west side of the bar has counteracted the accretions of the bar along the west bank and thereby has not only stopped the attack on the east bank at the site of the crossing but has caused considerable shoaling in front of this bank. Due to the wide, flat, and shallow bottom at this location, velocities are considerably less than at Fitler Bend and nowhere in this region do comparable scours take place.

The crossing having been selected, further studies were made to determine the nature and extent of changes that could reasonably be expected within the next 25 years. It is firmly believed that a design of any crossing of a meandering stream within an alluvial valley which is not based on such considerations invites sudden disaster. It is also firmly believed that many of the 22 lines abandoned at Fitler Bend would not have failed had they been laid at this new site in view of the highly favorable conditions which have existed there during the past 30 years.

Construction of New Crossings

A look at the future is by no means so encouraging. As previously stated, below the Fitler revetment and above the new site the east bank has receded in some places as much as 300 to 400 ft per year. Although recent surveys indicate the rates of recession are decreasing, continued migration of the east bank can be expected for many years unless the Fitler revetment is extended downstream.

To fully stabilize the east bank and avoid additional setbacks of the levee an extension of the revetment would be required and such an undertaking at some future time is quite likely. The principal changes that might occur at this crossing depend upon whether or not the Fitler revetment is extended. In either case the resulting changes would be accelerated and intensified by discontinuance of maintenance dredging west of Cottonwood Bar. Therefore, the principal changes on which the design is based are as follows:

1. *No extension of the Fitler revetment and discontinuance of maintenance dredging.* In this case recession of the east bank below the present Fitler revetment will continue at decreasing rates. The willow revetted bank at the east exits of the crossing will be outflanked from above. An estimated 10-year high bank is shown in *Fig. 1.* The recession of the east bank at the crossing during the next 10 years would be about 1000 ft.

2. *Extension of the Fitler revetment and discontinuance of maintenance dredging.* In this case further bank recession would be slight, if any. A rapid extension of the Fitler pool below the crossing site will result. A deepening and narrowing of the channel to low water depths of 50 to 60 ft, together with maximum velocities approaching those at Fitler Bend, can be assumed.

Consideration had been given initially to the utilization of a crossing consisting of two large-diameter lines dredged below estimated bottom scours and into the east bank beyond the extent of recession. However, after a little study of the characteristics of this reach of river, it appeared increasingly hazardous to base a design on any such rigid assumptions. Furthermore, after some idea was gained as to the extent of scour and recession that could be expected during the life of the lines, the estimated cost of dredging alone exceeded the overall cost of a multiple crossing.

Another significant consideration is the question of a factor of safety. If a given capacity is to be maintained, a single break can be provided for in a dual crossing only by having each line capable of carrying the desired capacity. With a number of smaller lines, one and possibly more breaks can be provided for with considerably less excess capacity and correspondingly less additional cost.

The crossing as designed and constructed is shown in *Fig. 2.* The lines are laid straight from the header on the Louisiana side across the accreting bar to areas where appreciable scour begins to take place on the channel side of the bar. The amount of slack is increased from an offset of 100 ft in 600 to 150 and 200 ft in 600. It is estimated that the 200-ft offset will accommodate a scour of about 75 ft in 600, which is well in excess of any that can reasonably occur at this location.

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maximum scours can be expected, and it is carried across the Mississippi bank to the vicinity of the headers to provide for the recession of the bank. The Mississippi header is located about 1200 ft from the present bank and behind the ten-year bank line; it can be moved further eastward when and if the bank recession necessitates.

Five different weights of line are used to offset the varying uplifts and densities. The ticks indicate where changes in weight are made. The minimum weight is used on the Louisiana bank and the high part of the bar adjacent to that bank. The maximum weight is used where maximum turbulence can be expected and is carried across the Mississippi bank to the vicinity of the header. If the Mississippi header is moved back, the same slack and weights will be extended to the new header.

For protection against caving banks, the Mississippi bank was trenched along the axis of the lines. The trench extended down to about the low water plane and backwards to a point 200 ft from the top of the high bank. The six downstream lines are 10¾-in. OD with ½-in. wall on the bar and ¾-in. in the channel. The seventh line is 12¾-in. OD ½-in. wall.

Cast iron clamps of 400 and 1000 lb are used on the 10¾-in. lines and 1800-lb clamps are used on the 12¾-in. line. The 10¾-in. pipe was used because it was either on hand or on order. Otherwise, the 12¾-in. x ½-in. pipe would have been used for all lines as it is equally or more satisfactory in every respect. It not only has almost twice the capacity of the 10¾-in. x ¾-in. line, but it weighs 15 lb per foot less and costs no more.

There are two other features of this crossing which may be of interest. One was a long-range river stage forecasting service which was worked out with and provided by the U. S. Weather office in Vicksburg. It is believed that no construction work is more sensitive to changes in river stages than a pipeline crossing. Not only was considerable lost time avoided due to timely information of impending high stages, but the final decision to shift the crossing to Cottonwood Bar was based upon a long-range forecast that sufficiently low stages would probably not exist to permit the construction of a crossing at Fitler Bend.

The other feature was the method of orientation. Positions in the river were obtained by resection from three points ashore with a three-arm protractor. Angles were read with a sextant and five targets were established which would permit sufficiently strong resections from at least three of the targets at any position in the river. This method afforded a rapid, precise, and simple system of orientation which proved far more satisfactory than any ever attempted in previous crossings.

In conclusion, it is desired to state that the foregoing analysis and design was derived with an open mind and without prejudice against either a multiple crossing or a large-diameter crossing dredged beyond estimated scours. The latter type of crossing was initially considered in line with the trend of present practice but was rejected for this site for the following principal reasons:

1. Constantly varying conditions together with the uncertainty of estimating future changes preclude a rigid construction and indicate the necessity of flexibility in design to give with the punch and to conform to possible but unpredictable changes.

2. A large-diameter line with heavy wall thickness and encased in concrete is inflexible and must be buried beyond possible scours or erosions.

3. Not only is a continuous history of scour not available at crossing sites but such intermittent surveys as are obtainable may be misleading and, accordingly, future estimates must necessarily be highly uncertain. The degree of such uncertainty is directly proportional to the probability of failure.

4. Disregarding astronomical costs, the limitations of even the most powerful dredges would not permit burying the line beyond scours and erosions believed possible at the Cottonwood site. A compromise based upon the assumption that continuous observation, especially under severe conditions of flood and drift, would permit further dredging in time to prevent failure borders, in my opinion, on wishful thinking. Not only are observations difficult under such conditions, but work could not be undertaken at best until the following low-water season.

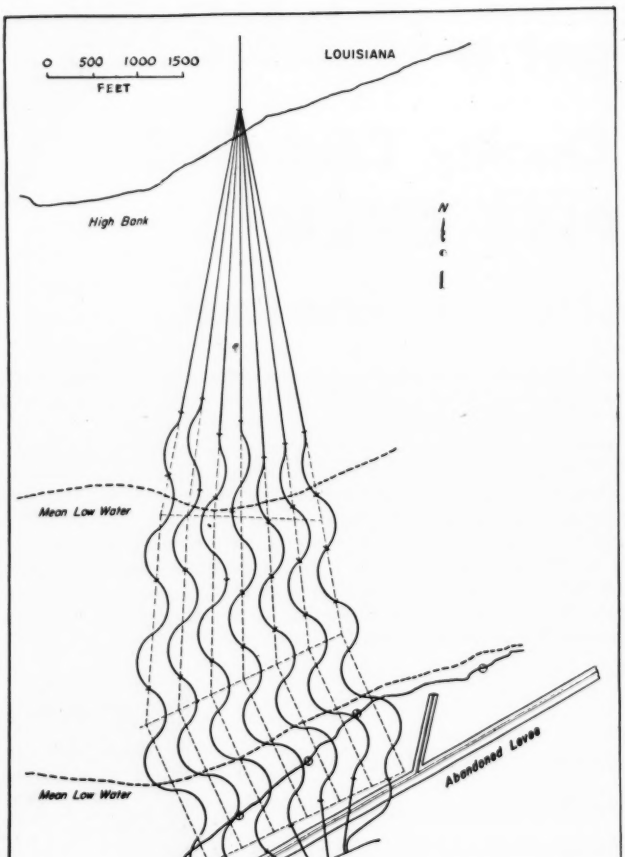

Fig. 2. Detail of parallel crossings as designed and constructed.

PIPELINE NEWS

Appeals Court Remands New England Case to FPC; Second Northeastern Application to be Considered

The question of whether Algonquin Gas Transmission Co. may have a slice of New England for its market area or whether Northeastern Gas Transmission Co. may yet get the whole melon was tossed right back into the laps of the FPC last month.

The Third U.S. Circuit Court of Appeals did the tossing, remanding the case for further consideration by FPC following lengthy wrangles between the two competitors for the lucrative northeastern business.

The court's decision was the latest incident in a year-and-a-half long fight that has ensued since FPC first decided to split up the territory between the two companies. Basis of the action was the contention that FPC did not give Northeastern's second application, in which it sought to serve all of New England, sufficient and fair hearing.

The decision comes at a time when Algonquin has about 50% of its line laid, with August completion scheduled. Northeastern already has its line in Massachusetts operating, with laterals to other neighboring states under construction.

The FPC decision to split the territories, which was bitterly assailed by Commissioner Thomas C. Buchanan, now chairman, was promulgated after extensive hearings during which FPC tried to get the two companies together on an integrated system. FPC believed that one pipeline would be more economical than two; and the two systems, as originally blueprinted, would have overlapped. When the two companies failed to agree, the commission worked out a split, contingent upon Algonquin's proving up a supply of gas.

Later, Northeastern came back with a new petition to FPC to supply the entire area. The application was denied. The court's action last month upholds the Northeastern contention that this application was not given fair consideration.

Counsel for Algonquin claimed that the argument of Northeastern was based on the false premise that if an applicant's petition to FPC is denied, the applicant may file a new application and be heard all over again on the same issues.

Said the court:

"We see no justification in the record for holding that the application was not bona fide. That second application and the then pending application of Algonquin were competitive and mutually exclusive. . . . Northeastern on that (second) application was entitled to a hearing called for by the Natural Gas Act.

"That company's second application, offering an integrated system by extending the distribution allowed it . . . to the remaining New England distributors, represented a task of no mean proportions. It outlined enormous savings in construction costs and to consumers.

"It stated that it would furnish service a year in advance of Algonquin. Among other things it asserted that its single system would save over 51,000 tons of badly needed steel. The application was filed while the Algonquin proceedings were still undetermined and within two and a half months after the commission's request. . . . The application was not untimely. Nor is there any legitimate inference that it was in bad faith."

Algonquin, which has already spent $19 million on construction, was considering an appeal, as was FPC.

On one front in its battle to get into New England, Algonquin managed to win a limited victory in April. In the Superior court at Jersey City, a temporary injunction sought by Parsippany-Troy Hills township to restrain the company from laying its line through the community was denied. Algonquin was told it could proceed "at its own peril."

The township had based its injunction on the company's alleged refusal to acknowledge jurisdiction of township zoning laws over location of the line and to abide by planning board rulings on subdivisions related to the line.

Alberta Approves Export Of Limited Volume of Gas

Alberta decided last month to permit export of its gas to the Pacific Northwest, but the volume approved for transport across the border was such a dribbling amount that the entire question of how, when, and from what source the area is to get the natural gas that it is so eagerly seeking still remains unsettled.

The conservation board tabbed Westcoast Transmission Co. as the chosen instrument to carry the gas, but recommended an allotment of only 300 billion cu ft. Spread over 30 years, that's 30 million per day — hardly enough to warrant the outlay of $100 million or so for the line.

N. Henry Gellert, president of Seattle Gas Co., and one of the chief protagonists in the battle to bring natural gas to the territory, immediately announced he had made an oral commitment to Ray Fish, head of Pacific Northwest Pipeline Co., Houston, to purchase Texas gas at from 35 to 38 cents a thousand. Pacific Northwest had originally planned to build the line from Texas to accomplish this purpose, but had dropped it in favor of alternate plans calling for reciprocal trades with Canada (*GAS*, April, p. 150).

Mr. Gellert said he had given Mr. Fish until the end of the year to obtain the steel and the necessary certificates to build the line. Mr. Fish said he was "starting work on the plan immediately."

The export plan was based on the fact that Westcoast proposes to draw gas from the Peace river area, near the western edge of the province. The geography of the situation was said to have influenced the conservation board in Westcoast's favor. Premier Ernest Manning later put his stamp of approval on the board's recommendation, and the legislature upheld it by a 41-4 vote.

A hearing on the permit by the Federal Board of Transportation Commissioners of Canada is scheduled to be held in Ottawa June 2.

These developments took some of the edge off a new application, filed with FPC last month by Trans-Northwest Gas Inc. of Spokane, Wash. Trans-Northwest plans to import natural gas from Canada to serve mar-

SECTION OF 26-in. line goes under a railroad crossing on Texas Gas Transmission Corp.'s 181-mile supply line in southern Louisiana. The line, recently completed, joins the company's gas-gathering subsidiaries in the Gulf Coast region with its main system in northern Louisiana.

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kets in eastern Washington and to export gas at the international boundary for service to Trail, B.C.

A concurrent application was made for a presidential permit for the import and export of the gas.

The import facilities would have a capacity of 100 MMcf per day and the facilities for the export service to Trail would have a capacity of 10 MMcf daily.

The proposed system would serve the Atomic Energy Commission's project at Hanford, Wash., as well as Grand Coulee, Spokane, Walla Walla, and Yakima, Wash.

Consolidated Hearing Set For 11 Applications

Eleven applications have been scheduled for consideration in a consolidated FPC hearing to get under way May 12.

Eight of the applications were filed by Mississippi River Fuel Corp., St. Louis, and involved requests for authorization to acquire, construct, and operate natural gas pipeline facilities designed to increase the company's sales capacity; to supply additional gas to existing customers and to several communities not previously supplied with natural gas; and to connect new sources of gas supply to Mississippi's system.

The other three applications were filed by St. Charles (Mo.) Gas Corp.; Arkansas Louisiana Gas Co., Shreveport; Interstate Natural Gas Co. Inc., Monroe, La.; and Hope Producing Co., Tulsa. The latter two companies filed jointly.

Arkansas Louisiana wants to build a line to serve Humnoke, Ark., and St. Charles is seeking authority to construct a line between St. Charles and Mississippi's facilities in Madison county, Illinois. Both companies ask to be supplied with gas by Mississippi.

The joint application by Interstate and Hope requests authority to abandon by Sept. 1, 1952, the sale of natural gas to Mississippi and the facilities used for delivery to the company.

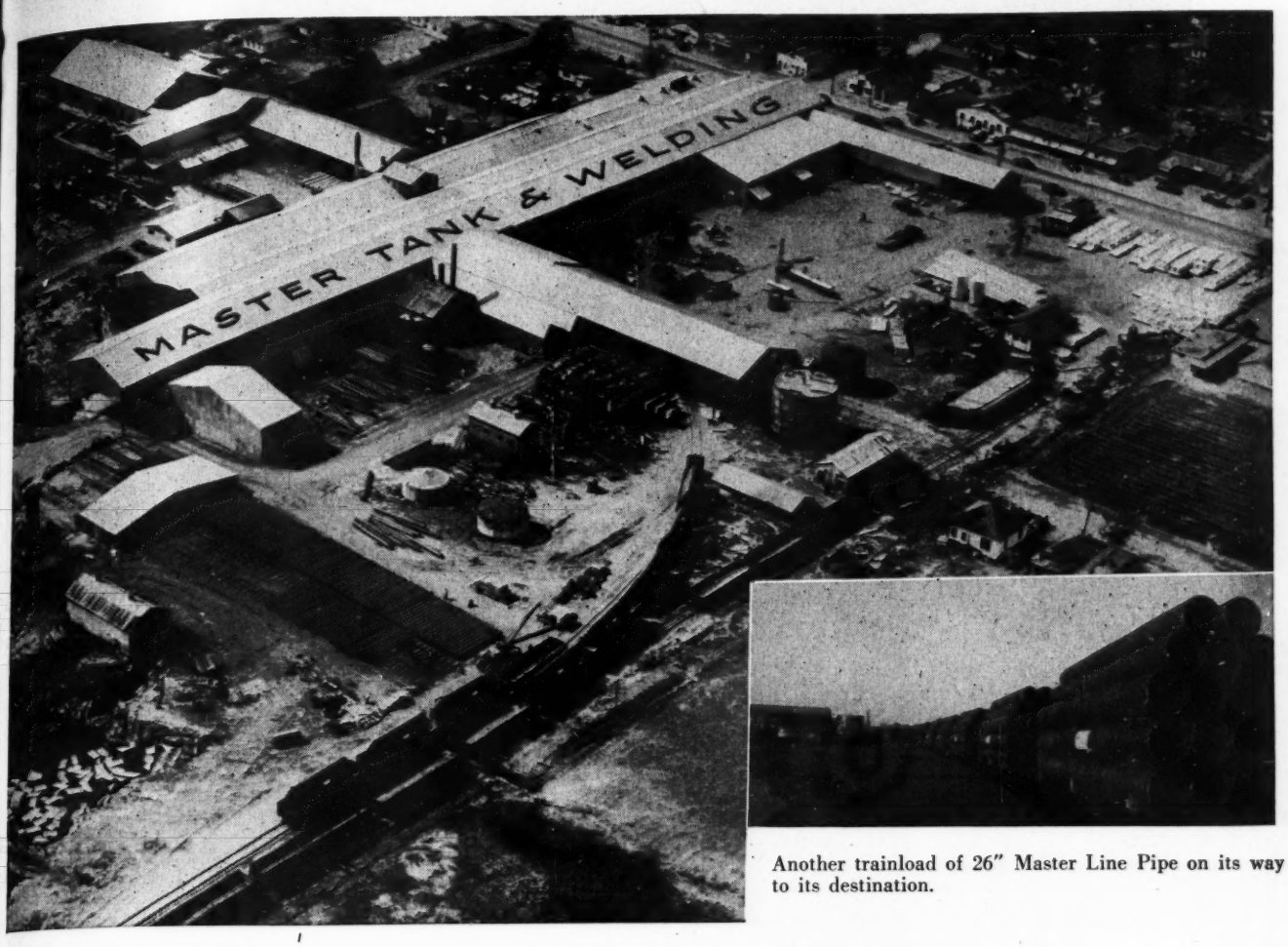
Texas Commission Tightens Flaring Regulations

A stricter policy regarding gas flaring is being adopted by the Texas Railroad Commission, headed by Olin Culberson. Natural gas is presently being flared in Texas at the rate of more than 7 billion cu ft a month. Two billion of that is being vented into the air at gasoline recycling plants while 5.6 billion is flared from oil wells with no pipeline connections for the taking of the casinghead gas.

The regulatory agency is most concerned about the 2 billion cu ft of avoidable waste. Bulk of this loss is in west Texas where Phillips Petroleum Co. alone flared 940,122 Mcf of gas in a single month.

The commission took action in its move to promote conservation by sharply cutting oil production allowables for 14 west Texas fields. Result will be a smaller volume of casinghead gas produced.

The 5.6 billion cu ft is flared in small volumes at wells located miles from gas gathering lines and would be economically infeasible to conserve.



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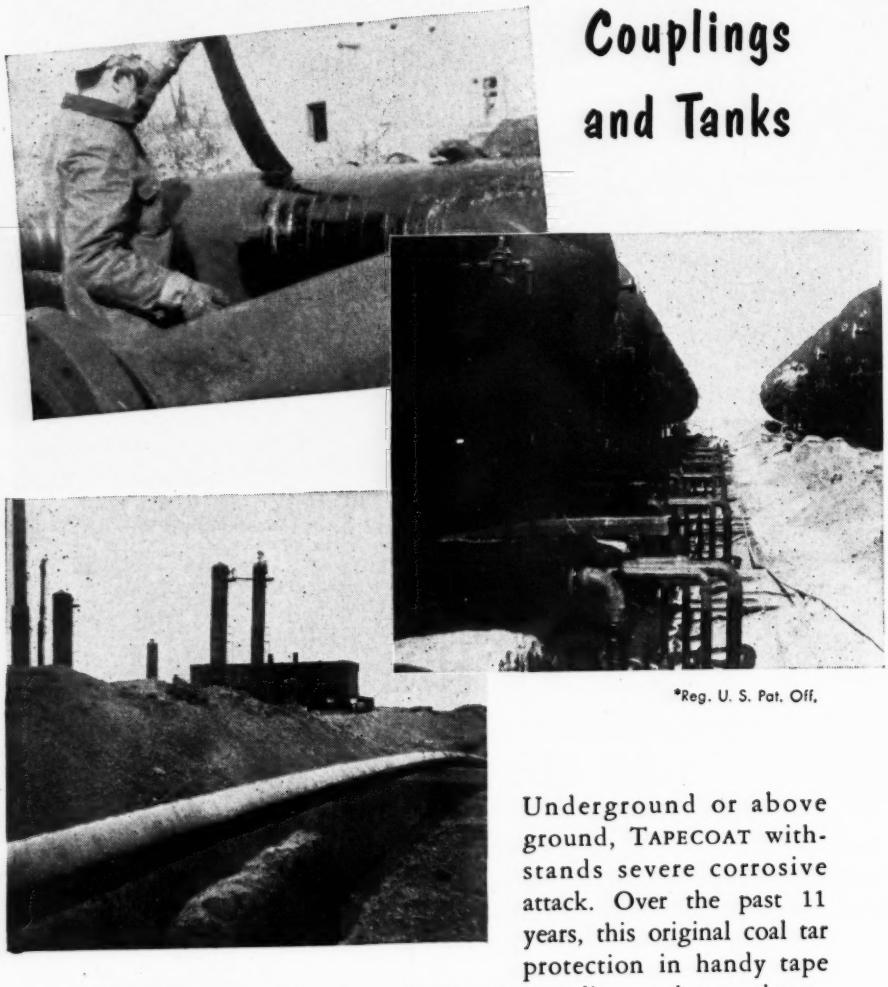

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Texas-Ohio Asks Okay to Import Gas From Mexico

Texas-Ohio Gas Co., Houston, has filed applications with FPC requesting authority to import natural gas from Mexico and for a Presidential permit for the construction, maintenance, and operation of facilities to transport the gas.

The commission dismissed hearings on Texas-Ohio's pending application for authority to build a 1439-mile system from Texas to West Virginia on April 17 after the staff counsel filed a motion to dismiss the proceeding.

The company plans to purchase 200 MMcf per day from Petroleos Mexicanos, a Mexican corporation which owns and controls large gas fields in Mexico. Under a contract between the two companies, these reserves are dedicated to Texas-Ohio's proposed pipeline.

The Houston company, meanwhile, is opposing the move for dismissal of its request to build the line to West Virginia. It was contended that the company was not prepared to prove a market for the 505 MMcf design capacity. Texas-Ohio says it has the gas, finances, pipe, and personnel necessary to get natural to West Virginia where it is urgently needed.

Resolutions Adopted At TIPRO Annual Meeting

At the sixth annual meeting of the Texas Independent Producers & Royalty Owners Assn. held March 27-28 in Fort Worth, the association adopted eight resolutions.

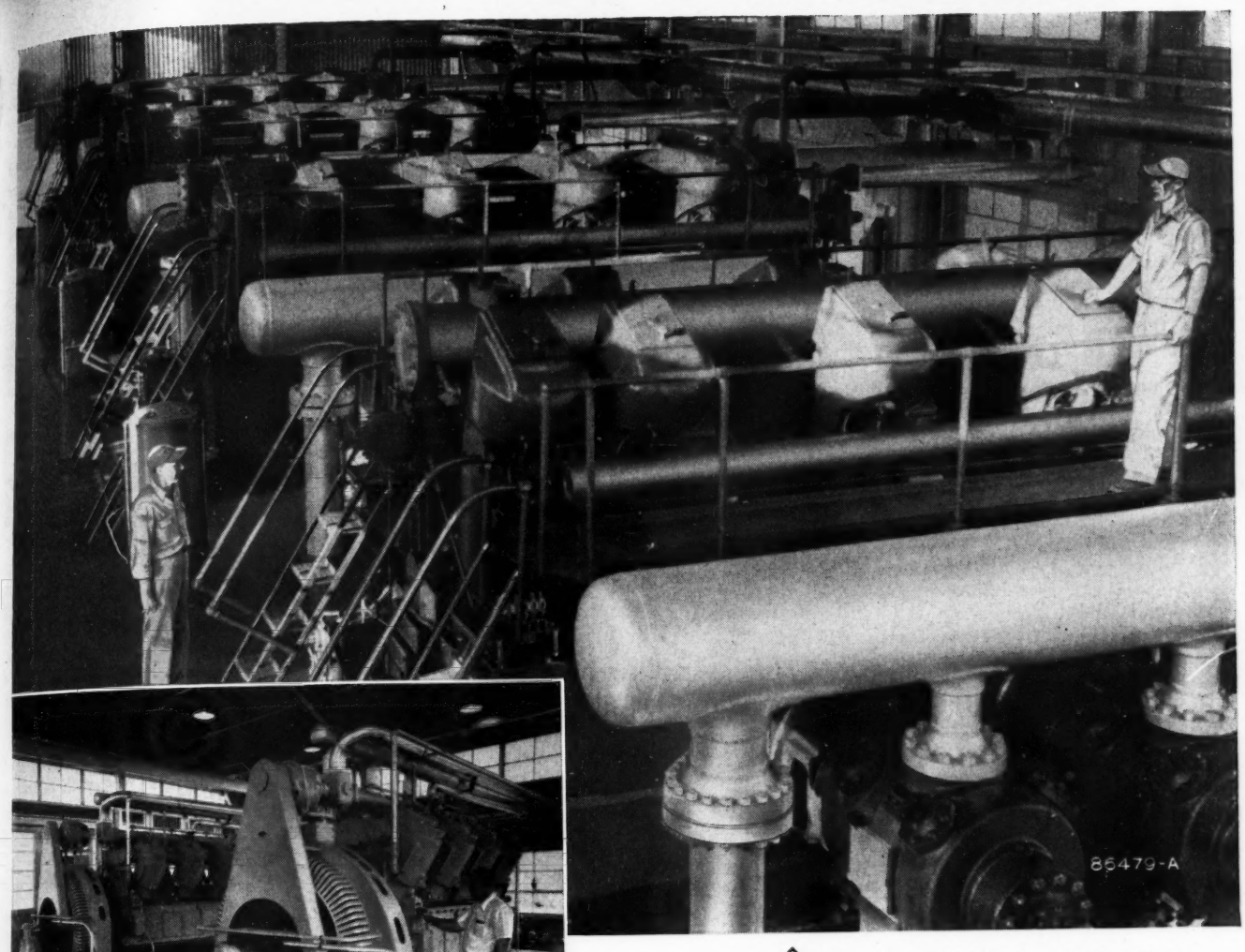
In brief, the resolutions endorse the following association actions: (1) Reaffirm its position favoring a minimum wellhead price. (2) Oppose S. 1000 concerning a gas company's right to condemn an individual's land for underground storage of gas. (3) Favor legislation to require gas purchasers to post prices they are paying in each field. (4) Reiterate its stand opposing compulsory unitization.

(5) Work for removal of ceiling prices from commodities not in short supply. (6) Oppose enactment of interim legislation concerning the tidelands and appoint a committee to make the association's influence felt on this matter. (7) Reiterate its stand against the supplanting of domestic production with foreign oil. (8) Bring to the attention of those affected (through local TIPRO directors) evils concerning ad valorem taxes.

Carthage Field Station Planned By Tennessee Gas

Construction of a 2640-hp compressor station in the Carthage field, Panola county, Texas is planned by Tennessee Gas Transmission Co., Houston, if FPC permission is granted.

Tennessee purchases 100 MMcf of gas in the Carthage field per day from the Chicago Corp. The gas is then transported by United Gas Pipe Line Co. to a connection with Tennessee's system in Louisiana. According to



Four Ingersoll-Rand 1320-hp Type KVG Compressors at Slaughters, Kentucky, station.

Two 406-hp Type PVG Gas Engine Generator units at Jeffersontown, Kentucky, station.

I-R COMPRESSORS and ENGINES on Texas Gas Transmission Corp. Line

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the application, the natural pressure of some of Chicago's gas wells has diminished to the extent that gas can no longer be delivered at the pressure required by United without compression.

As proposed, with 2640 hp, the station will cost an estimated $880,000 and by 1955 additional horsepower will be required, the company states.

Permian Basin Applies For $58 Million System

The newly formed Permian Basin Pipeline Co., Chicago, has asked for FPC authority to construct a 284-mile pipeline system to extend from the Permian Basin area of west Texas and eastern New Mexico to the Panhandle area of Texas.

Estimated cost of the system is $58,180,000. It would include four compressor stations with a total of 74,360 hp and use 20- to 30-in. pipe. Ultimate capacity of the line would be 300 MMcf per day.

Northern Natural Gas Co., Omaha, has an option to purchase all, or the first 100 MMcf of the initial capacity, and a continuing option to purchase all or any part of the additional capacity as it becomes available. Permian would take gas from Phillips Petroleum Co., Gulf Oil Corp., the Ohio Co., Plains Production Co., Amerada Petroleum Co., and Cities Service Oil Co.

Lone Star Producing Co. Builds Gasoline Plant

Lone Star Producing Co., Dallas, has begun construction of a $3 million gasoline plant for the processing of casinghead gas from the Fort Chadbourne oil field in west Texas.

The field, situated in the northern part of Runnels and Coke counties, contains approximately 250 oil wells operated by 11 producing companies. To prevent gas waste by flaring, the field was shut in Feb. 1 by order of the Railroad Commission of Texas.

The new plant will have capacity to process 30 MMcf of casinghead gas per day and will produce natural gasoline and propane and butane gas. Facilities will also be provided to inject the residue casinghead gas into the reservoir for repressuring.

More than 22 miles of 2- to 16-in. pipe will be installed initially to gather gas from the first-stage separators serving the 250 wells.

FPC Approves Purchase And Resale of Facilities

Manufacturers Light & Heat Co., Pittsburgh, has received approval from the Federal Power Commission for purchase of the 2400-hp Carnegie compressor station in West Virginia and 136 miles of natural gas transmission line from United Fuel Gas Co., Charleston. Estimated cost of the facilities is $3,065,980.

At the same FPC hearing, United received approval for the purchase and resale of the Carnegie compressor and for the purchase of two compressor units and a dehydration plant from United States Steel Co.

The facilities which Manufacturers acquired were previously used by United to transport gas to Manufacturers and U. S. Steel. The steel company will now be supplied by Manufacturers, as the latter company can operate the facilities more economically and practically.

Transco Would Up Capacity; Also Wants Rate Increase

Transcontinental Gas Pipe Line Corp. plans to increase the capacity of its line to carry an additional 210 MMcf of natural gas daily in 1953, raising its daily line capacity to 765 MMcf. The line gathers natural gas from south Texas and delivers it to New York, Philadelphia, Newark, and other eastern cities.

The firm earned a net income of $5,380,115 during the ten months of 1951, commencing in March, that it was an operating company. Some deliveries were made during the final stages of construction and the

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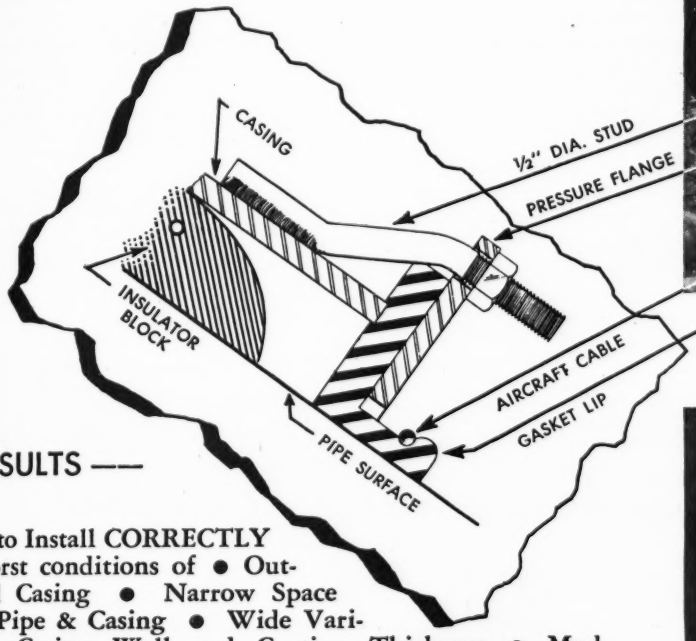
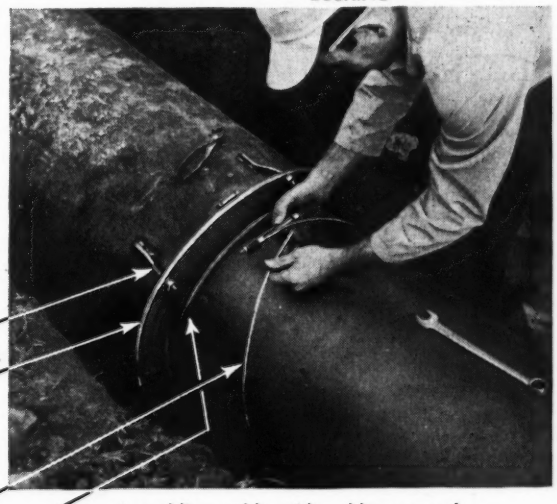
TYPE "L" WmSEAL CASING BUSHING*

A New Design: It BUTTS Against End of Casing Instead of Fitting Inside the Casing.





Assembling cable with rubber-covered union for clamping gasket lip to pipe.

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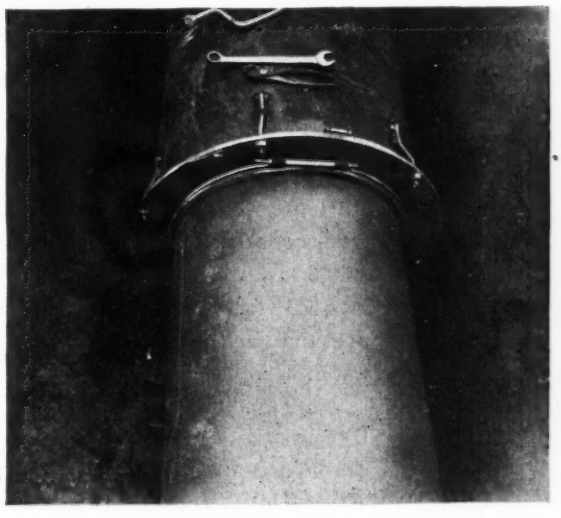
2. WATER-TIGHT Seal with "L" gasket . . . . . .
   - BUTTED AGAINST CASING as pressure flange is tightened on ½" studs welded to casing.
   - TIGHT TO THE PIPE as aircraft cable (4,600# tensile) is tightened to gasket lip. Union is rubber covered to INSULATE galvanized cable assembly from bare casing structure.
3. Always Insulated from the pipe line when a Concentric-Support Insulator is installed just inside casing after the "drag section" is in place.



THE COMPLETED INSTALLATION
Note that galvanized cable and union are insulated from pressure flange and from pipe.

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*Patent Pending

WRITE FOR BULLETIN 249A

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TULSA 9, OKLAHOMA

8,000 Pipe Line Casings installed in 1951 with Williamson Bushings and Insulators

net revenue from these sales, amounting to $2,545,207, was applied as a reduction in the amount of interest charged to construction. Operating revenue for the ten-month period amounted to $39,302,881. Net earnings amounted to $1.21 a common stock share.

The company has applied to the Federal Power Commission for rate increases which will add $13,654,000 to its gross income.

Worthington Changes Name; Holds Six Conferences

At the recent annual meeting of Worthington Pump & Machinery Corp., Harrison, N.J., stockholders voted to change the firm's name to Worthington Corp. The change was made, according to H. C. Ramsey, president, because the company has expanded to produce varied equipment for industrial and commercial use.

"Because of our wide diversification," he said, "we believed that the continued reference to pumps in the corporate name tended to lead the public into the erroneous conclusion that pump manufacture was our only endeavor."

Shortly after the annual meeting, Worthington held a series of six district sales managers' conferences at its plants in Wellsville and Buffalo, N.Y.; Holyoke, Mass.; and Harrison, Dunellen, and Succasunna, N.J. Purpose of the meetings was to bring sales managers up to date on the company's production improvements, manufacturing facilities, and future plans.

Tulsa Pipe Coating Co. Changes Corporate Setup

Tulsa (Okla.) Pipe Coating Co., a partnership, recently changed its entire structure, retaining only American Coating Supply Co., Tulsa, as a partnership.

Five other corporations exist: Tulsa Pipe Coating Inc. — Lee Laster, president, G. L. Laster and Ivan L. Brunkow, vice presidents; Pipe Coating of Tulsa Inc., Oklahoma City, and American Pipe Coating Inc., Tulsa — Gaines Laster, president, and Mr. Brunkow, secretary-treasurer; Tulsa Coating Inc., Hugoton, Kan. and Tulsa Coating Equipment Inc. — Mr. Brunkow, president, and Gaines Laster, secretary-treasurer.

All of the companies maintain headquarters at 2240 E. Apache, Tulsa.

Allocation Battle Ended

FPC has terminated the proceedings in regard to the Public Service Commission of Wisconsin request for the "proportionate and equitable" share of natural gas to which the state is "justly entitled." The company had asked that Michigan-Wisconsin Pipe Line Co. be ordered to supply its customers in Wisconsin.

The proceedings which were instituted Oct. 9, 1951, were ended because the apparent purpose of the petition had been satisfied, according to the FPC. The parties involved had reached an agreement on a proposed plan of allocation at conferences held during the winter.

Michigan-Wisconsin subsequently filed proposed emergency service rules and regulations intended to effectuate the allocation plan agreed upon. The rules were accepted for filing by the FPC.

MidSouth Order Dismissed By Arkansas Commission

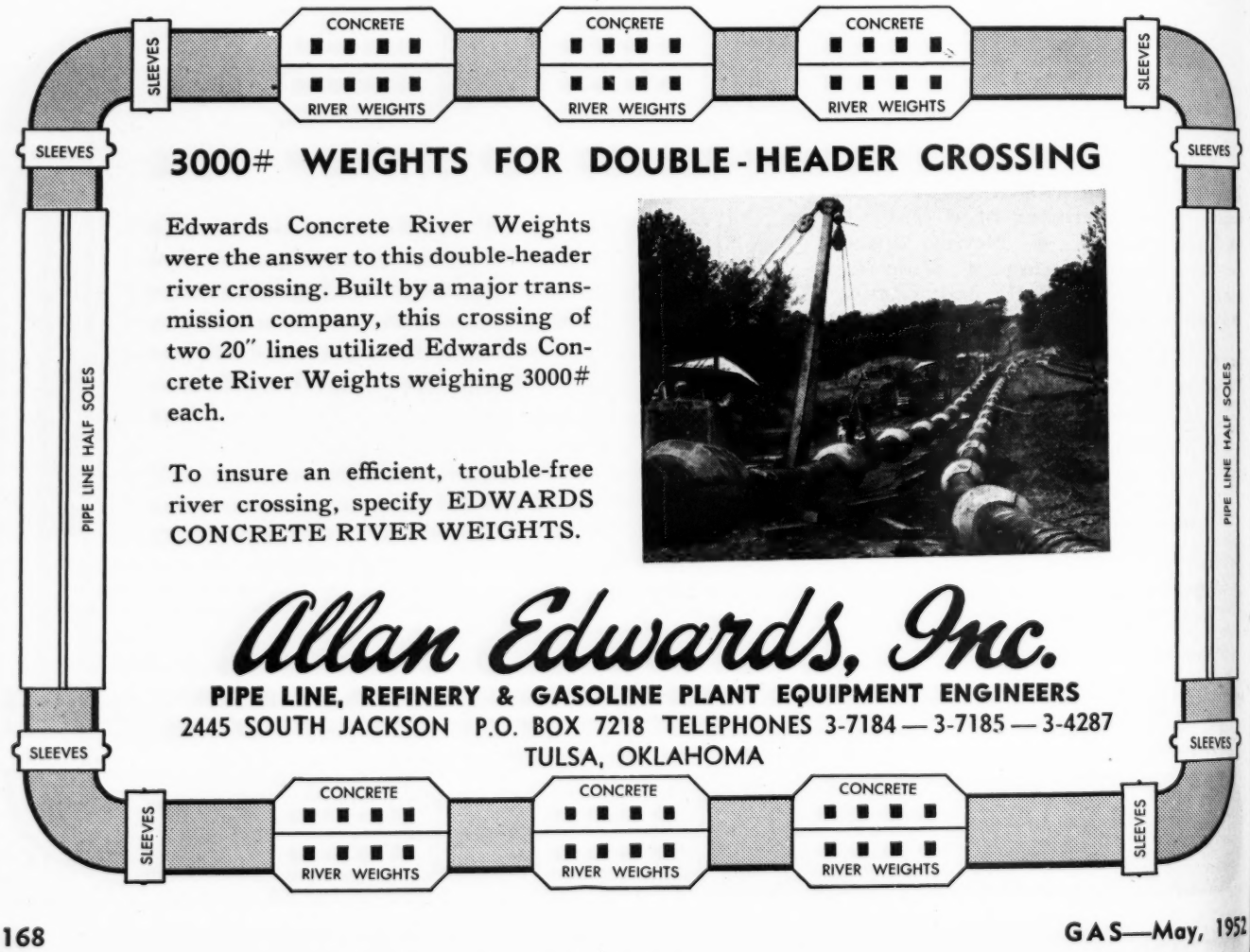
The Arkansas Public Service Commission has dismissed its order requiring MidSouth Gas Co. to "show cause" for the delay of construction for service to eastern Arkansas and to explain why FPC construction certificates should not be revoked.

The PSC said MidSouth had filed a progress report giving satisfactory reasons for its inability to supply the gas. The company's report stated that extension of franchises had been granted by the towns concerned until an allocation of gas is received from FPC.

The commission is conducting a hearing on an application of Texas Gas Transmission Corp. for expansion of its facilities to supply MidSouth. MidSouth has already expended about $1 million for engineering plans, surveys, and materials and has obtained much of the pipe needed for the distribution systems.

Utah Firm Asks Extension

Utah Natural Gas Co., Salt Lake City, has asked the Utah Public Service Commission



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for an expansion of its operating authority and a 30-day extension to amend an application filed last year.

The company wants to construct pipelines from Carbon county, where a substantial quantity of gas has been discovered, and to tap southeastern Utah for gas to pipe to the Salt Lake industrial area. It was granted a conditional permit last year to construct a $32 million pipeline with April 8 as the deadline for proving reserves and securing a firm financial commitment.

Associated Plans Line

Associated Natural Gas Co., Tulsa, plans to construct 32 miles of pipeline in Missouri if FPC permission is granted. Estimated cost of the project is $894,320.

The company would supply gas received from Texas Illinois Natural Gas Pipe Line Co. to Jackson, Mo. Gas acquired from Texas Eastern Transmission Corp. would be used to supply Portageville, Gideon, Morley, Spoonerville, and Bernie, Mo.

Pipeline Newsnotes

An FPC's examiner's decision recently authorized Transcontinental Gas Pipe Line Corp., Houston, to build a metering station and sell 4 MMcf daily to the Laurens (S.C.) Glass Works Inc. The decision was subject to the condition that the new service be subordinate to fulfillment of Transco's present requirements, although the company would not be required to give added service for emergency or exchange deliveries to present customers if it necessitated curtailment of service to Laurens.

A contract for construction of an undetermined number of miles of 30-in. line in Ohio, West Virginia, and Pennsylvania has been signed by H. C. Price Co., Bartlesville, Okla., with Brown & Root Inc., agent for Texas Eastern Transmission Corp. Two Price spreads got under way last month at Moundsville, W. Va. and Woodsfield, Ohio. Superintendents are R. K. Shivel and Charlie Ice.

Trial of three suits attacking Texas' natural gas gathering tax has been set for May 12 in the 126th district court at Austin. Suits brought by Panhandle Eastern Pipe Line Co. and Michigan-Wisconsin Pipe Line Co. have been twice postponed. A third, filed by Amarillo Oil Co., has been transferred from the 53rd district court for trial with the other two.

A fourth pipe coating and wrapping yard has been opened in Charlotte, N.C. by Rosson-Richards Co., Houston. Others are located at Jackson, Miss., Corpus Christi, and Houston. The Charlotte installation, with J. R. Meyers in charge, has the capacity to coat and wrap from 10,000 to 30,000 ft per day in a range of sizes from ¾- to 30-in.

T. D. Williamson Inc., Tulsa, has published an eight-page folder titled "Instructions for Installing 1952 Pipeline Road Crossings." The bulletin explains the use of the company's Type L "WmSeal" casing bushings and concentric-support insulators. Step-by-step photographs and diagrams are included.

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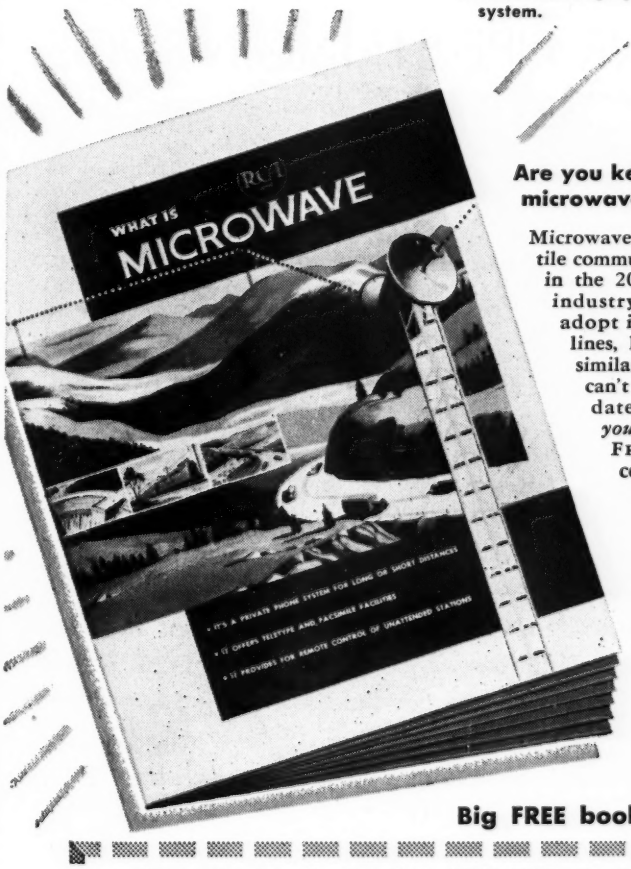
3. **How microwave operates a pumping station by remote control.**
4. **What goes into a typical microwave system.**
5. **How RCA helps you install your microwave system.**



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PROGRESS REPORTS

Planned

ARKANSAS-MISSOURI POWER CO., Blytheville. Docket G-1900 for a line from Campbell, Mo., to Blytheville, Ark., and a line from a point just west of the St. Francis river in Clay county, Ark., to Rector, Ark. The total of 140 miles of pipeline is to serve 13 communities in Arkansas and 5 in Missouri.

ASSOCIATED NATURAL GAS CO., Tulsa. Docket G-1929 for 32 miles of line for service to Jackson, Portageville, Gideon, Morley, Spoonerville, and Bernie, Mo.

ATLANTIC SEABOARD CORP., Charleston, Docket G-1850 for three new compressor stations aggregating 16,500 hp, with 1980 hp addition to be installed in existing station, all in West Virginia.

CENTRAL KENTUCKY NATURAL GAS CO., Charleston. Docket G-1905 for 8.8 miles of 20-in. pipeline to parallel an existing section from North Means, Ky., to Cincinnati.

CENTRAL WEST UTILITY CO., Kansas City, Docket G-1682, four alternate plans to serve Clay county, Mo.

CHICAGO DISTRICT PIPELINE CO., Joliet, Docket G-1756 to build 15 mile, 30-in. line in Cook county, Ill.

COLORADO-WYOMING GAS CO., Denver. Docket G-1821 for 2 mile, 3-in. line from Johnstown to Milliken; and 4 mile, 6-in. line to Rocky Flats Plant of the Atomic Energy Commission.

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EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with appurtenant equipment.

EL PASO NATURAL GAS CO. Docket G-1631 for 112.9 miles 30-in., 179.5 miles field lines, 98,200 hp added capacity plus 36,540 hp in field stations, field gathering systems, and miscellaneous facilities; 133.3 miles main line loop; 14,800 additional compressor hp in existing stations; 105,000 hp in new and authorized main line booster stations; new field lines and field compressor stations and additions; purification and dehydration plants; field gathering systems; amine recovery plants; and other miscellaneous facilities.

EL PASO NATURAL GAS CO. Docket G-1630 for 25,050 hp at new and existing stations, 50.9 miles field lines, 2700 hp at a field plant; gas wells and miscellaneous facilities; 36.9 miles of main line loop; 32,560 miles in main line compressor hp; field transmission lines, compressor stations and gathering system; dehydration plants; a gasoline absorption plant; gas wells; and communication facilities.

GLACIER GAS CO., Butte, Mont. Dockets G-1816, G-1817, G-1818 for 285 miles of 20-in. from northeast of Kalispell, Mont. to Spokane, Wash.; 91 miles of 8⅝-in. from Spokane to Lewiston, Idaho; 120 miles of 16-in. from Spokane to Hanford, Wash.; 130 miles of 12¾-in. from Spokane to south of Trail, B. C.

HOME GAS CO., Pittsburgh. Docket G-1893 for 32.5 miles of line in Chemung and Broom Counties, N. Y.

KANSAS NEBRASKA NATURAL GAS CO., Hastings. Docket G-1857. To build 179 miles of line in Kansas and Nebraska and rearrange certain compressors, stub lines and metering stations to serve new main line industrial customers.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh, Pa. Docket G-1893 for 40 miles of pipeline in Allegheny, Washington, and Beaver counties, Pa., and Belmont, Jefferson, and Columbiana counties, Ohio.

MIDSOUTH GAS CO., Little Rock, Ark. Dockets G-1445 and 1680 for 240 miles of line in Greene, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, Poinsett, and Cross counties, Ark.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket No. G-1933 for a 2640-hp compressor station in Butte county, S. D.

NATURAL GAS STORAGE CO. OF ILLINOIS, Chicago. To build facilities to develop an underground storage area 15 miles from Kankakee, Ill.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket No. G-1888 for 114 miles of 10¾-in. line from Topock, Ariz., to Las Vegas area, Henderson, and Boulder City.

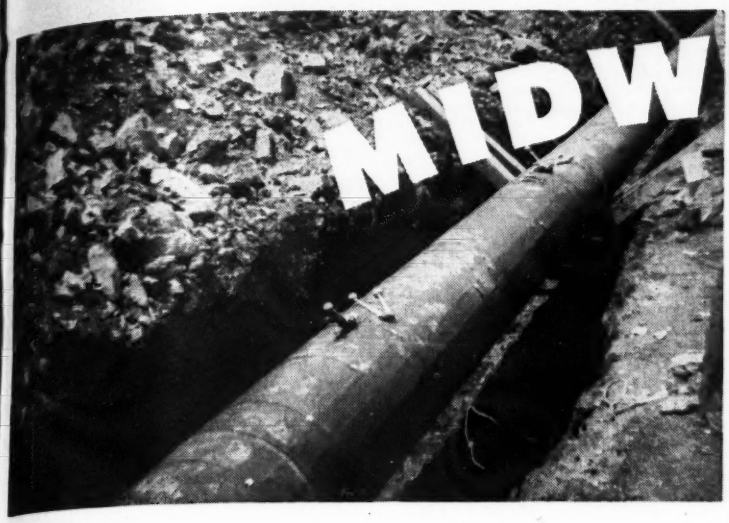
NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHWEST NATURAL GAS CO. Docket G-996 for 645 miles of 18-, 20-, 22-, and 24-in. line in Washington, Idaho and Oregon together with laterals and four compressor stations aggregating 24,750 hp.

OHIO FUEL GAS CO., Columbus. Docket G-1911 for 33 miles of 20-in. to replace 42 miles of existing 8⅝- and 10¾-in. pipe in Crawford, Wyandot, and Seneca counties, Ohio.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1651 for 86.25 miles 34-in. loop and 19,540 hp at authorized stations.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1892 for 20 miles of 16-in. line from Burrell to a point near Easton and 15 miles of 20-in. pipe extending from Helm and joining the system's Topock-Milpitas line in Fresno



MIDWESTERN Offers KAPCO ROCK SHIELD

- For protecting pipe and coating in rocky areas.
- Fast and easy to apply, cuts time in difficult areas.
- For use whenever and wherever pipe and coating are subject to rough handling.
- Offered by Midwestern in a complete package of Rock Shield, metal or glass-fiber strapping, strapping tools.

Kapco Rock Shield is the pioneer of all rock protective coverings. In many cases it completely eliminates padding the ditch and has been used with equal success at river and road crossings, padding under river weights, as a protective factor at pipe anchors and elsewhere where pipe and coating are subject to damage in handling. As a direct result of its effectiveness . . . *Kapco has been used on every major pipeline job during the past five years.*

Both extra heavy duty and flexible-type Kapco Rock Shield are easily applied and do not require scoring for application.

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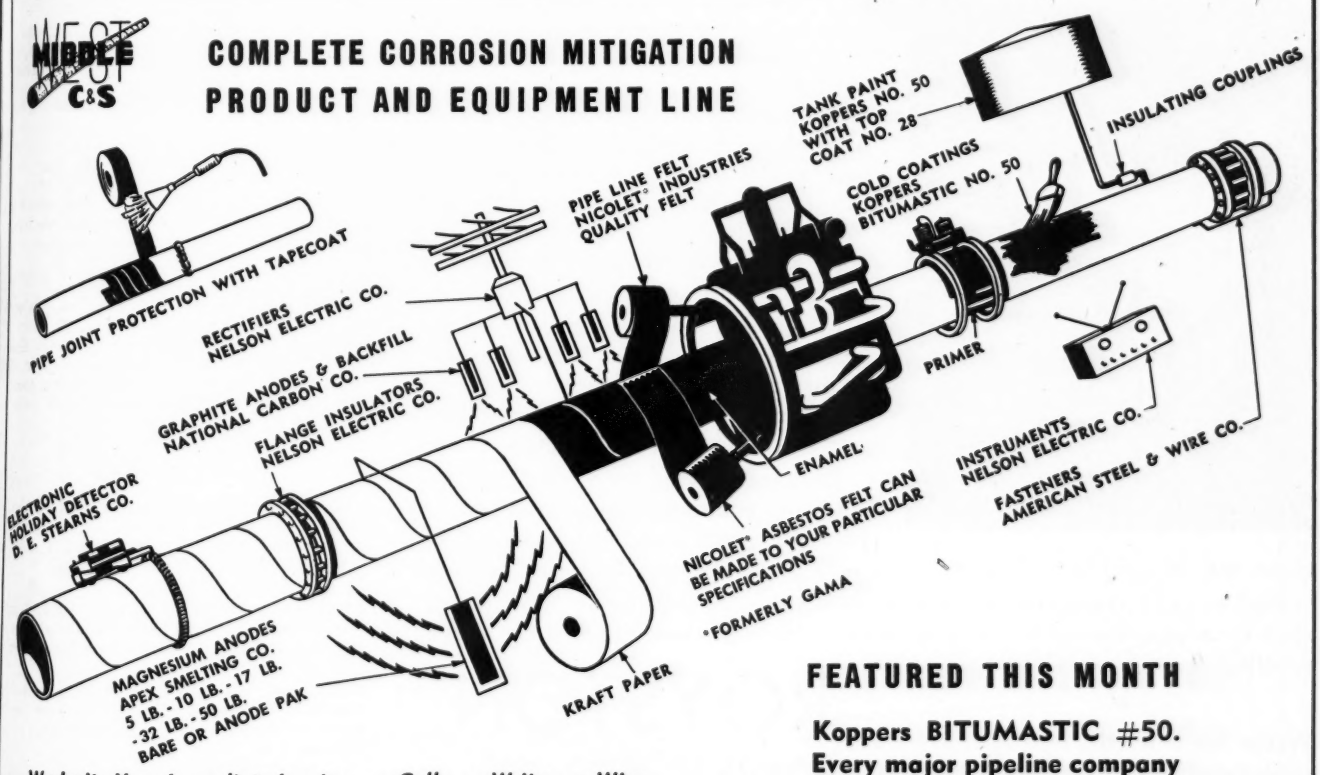
TANK PAINT KOPPERS NO. 50 WITH TOP COAT NO. 28
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Koppers BITUMASTIC #50. Every major pipeline company has purchased this cold-applied protective coating from us.

county; and for 15.5 miles of 12¾-in. in Madera county parallel to the existing Madera-Livingston line.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Dockets G-1429, G-1908, and G-1909 for 828 miles of line to serve Portland, Ore., and Spokane, Seattle, and Tacoma, Wash.

PERMIAN BASIN PIPELINE CO., Chicago. Docket G-1928 for a 384-mile line from Upton county, Texas, through Lea county, N. M., north to Roosevelt county, N. M., and northeast to Carson county, Texas, connecting with facilities of Northern Natural Gas Co.

PIEDMONT GAS CO. INC., Hickory, N. C. Docket G-1617 for 28 miles 6-in. line.

ROCKLAND LIGHT & POWER CO., Nyack, N. Y. Docket G-1728 for 22 miles transmission line between Orangetown and Tomkins Cove, N. Y.

SOUTH GEORGIA NATURAL GAS CO., Birmingham. Docket G-1915 for a 339-mile line to serve communities in southwest Georgia and northern Florida. Main trunk would connect with system of Southern Natural Gas Co. in Lee county, Ala., and extend to Albany, Ga., with a branch to Tallahassee, Fla.

SOUTHERN CALIFORNIA GAS CO. and **SOUTHERN COUNTIES GAS CO.,** Los Angeles. Docket G-1718 for 14 miles 30-in. line between Whitewater and Desert Center, Calif., 6 miles 30-in. from Blythe, Calif. station to Calif.-Ariz. border, and two 1760-hp compressors at Blythe.

SOUTHERN NATURAL GAS CO., Birmingham. Dockets G-1676 and G-1907 for 1254.7 miles of various size pipelines and seven compressor stations totaling 33,300 hp in Alabama, Georgia, Mississippi, Louisiana, and South Carolina.

ROSKOTE cold-applied anti-corrosion mastic saves time...saves money...SAVES PIPE!

Roskote's drying speed, its handling ease and its high electrical resistivity makes it the ideal mastic for pipeline protection, winter or summer. Whether you are protecting distribution and service lines, or large transmission lines in yard or field, it will pay you to investigate...

cuts field costs because it is applied COLD — either brush, spray or special line-traveling machine — without primer or field mixing. It eliminates labor, equipment and hazards of hot-applied materials. It is fast-setting to a tough, flexible film of high electrical resistivity (20 megohms per sq. ft.) without brittleness or sag through a temperature range of −40° to 375°F. It dries to the touch in 20 minutes and is ready for backfill in an hour.

Roskote's resin base resists acids, alkalies, salts and moisture. It bonds readily to previous coatings of coal tar or asphalt. Wire brushing is the only preparation needed for old pipe.

Roskote's drying speed and handling ease cuts man-hours from work schedules and speeds pipe-line progress. That saves real money! Yet Roskote costs only 3¢ per square foot of coverage.

Used by over 70 utilities and pipeline companies for coating at "hot spots," road crossings, for valves, joints, meters, drips; for patching and for waterproofing concrete regulator pits.

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Write for bulletin containing complete technical specifications, chemical and electrical properties and application information. Ask for the Roskote special trial order offer.

ROYSTON
LABORATORIES, INC.,
BLAWNOX, PA.

MANUFACTURERS OF QUALITY INDUSTRIAL COATINGS RESISTANT TO CORROSION BY ACIDS, ALKALIES, ELECTROLYSIS, HEAT, MOISTURE AND WEATHER.

TENNESSEE GAS TRANSMISSION CO., Hou... Dockets G-1921 and G-1922 for a preside... permit to construct and operate facilities at International Boundary north of Niagara Fa...

TENNESSEE GAS TRANSMISSION CO., Hous... Docket G-1930 for a 2640-hp compressor ... tion in Carthage field, Panola county, Texas.

TENNESSEE GAS TRANSMISSION CO., Houston ... Dockets G-1573 and G-1614 for 591 miles o... line parallel to existing system, a 304 mile line from near Mercer, Pa. to Utica, N. Y. with a total of 165,000 hp to be installed at new and existing compressor stations. Also 250 miles of miscellaneous lines.

TEXAS GAS TRANSMISSION CORP., Owensboro. Docket G-1847 for 407 miles 26-in. loop line on sections of existing line between Bastrop, La. and Hardinsburg, Ky. together with installation of 14,620 hp.

TEXAS-OHIO GAS CO., Houston. Docket G-1810 for 1439 miles of 30-in. from Hidalgo county, Texas, through Arkansas, Mississippi, Tennessee, Kentucky, Ohio, and terminating near Spencer, W. Va., including 14 compressor stations totaling 135,000 hp.

TRANS-CANADA PIPE LINES LTD., for 2200-mile line from Alberta to major cities as far east as Montreal.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1879 for compressor stations at Napoleonville and Jackson, Miss., for 13,280 total hp; and an addition of 8,000 hp at authorized stations near Montpelier, La., and in Waltha... county, Miss.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1880 to build 36 mile line from a point near Ingleside, Tex., for connection with system near Refugio, Tex.

UNITED NATURAL GAS CO., Oil City, P... Docket G-1854. To build 15.1 miles 12-in. li... and replace 6.5 miles 8-in. line in Venan... county, Pa., and to build 12.4 miles 6-in. li... and replace 2.7 miles of 3-in. line in War... county, Pa.

UTAH NATURAL GAS CO. to build a 360-m... line from the San Juan basin to Salt Lake City; secondary line would run from Last Chance fi... (Wayne county, Utah) through Sevier and Sa... pete counties.

WESTCOAST TRANSMISSION CO. INC., Wi... mington, Del., 349 miles, including 277 mile... from Sumas, Wash. to Portland, Ore. with sho... branches to a number of cities in the two state... and 72 miles of laterals and 13 measuring st... tions.

WESTERN SLOPE GAS CO., Denver. 49 mile... of main transmission line and 30 miles ... gathering lines to bring natural gas to Gra... Junction from the Douglas Creek field, R... Blanco county; Germesa field, Garfield coun... and Highline Canal and Asbury Creek fields ... Mesa county.

Under Way

ALGONQUIN GAS TRANSMISSION CO., Bosto... facilities to serve designated companies in Mas... R. I., Conn., and N. J. Includes 253 miles ... main line and 279 miles of laterals.

CENTRAL ILLINOIS LIGHT CO., Peoria. Some... ville Construction Co., Ada, Mich., is at work ... 18 miles of 16-in. forming a loop around Peor...

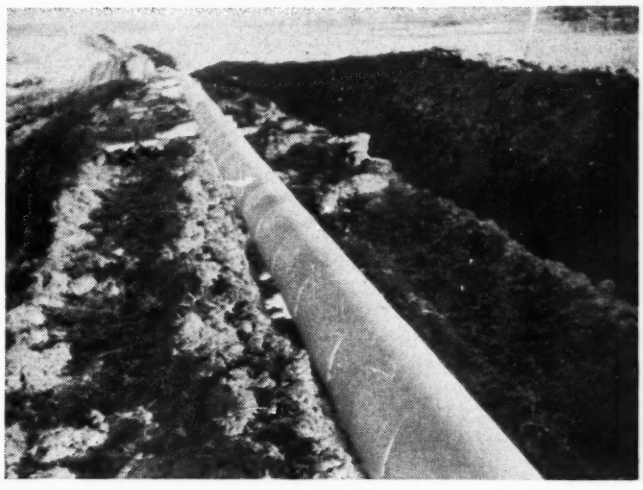
CITIES SERVICE GAS CO., Oklahoma City, ... Engineering Construction Co. at work on ... miles 4- to 16-in. in vicinity of Liberal a... Ulysses, Kan.

NEW YORK STATE NATURAL GAS CO... Pittsburgh. Docket G-1824 for 104.7 miles ... line in Pennsylvania and New York and insta... tion of an additional 2420 hp at two exis... compressor stations in Westmoreland and Ti... counties, Pa. Williams-Austin Co. is at work ... 12 miles of 20-in. loop at Zelienople, Pa.

NICOLET *Light Weight* ASBESTOS PIPE LINE FELT

A NICOLET DEVELOPMENT — TO OBTAIN GREATER ROLL LENGTHS

This on-the-job photo shows the application of Nicolet 6# Asbestos Pipe Line Felt at Warrensburg, Missouri, in early 1952. Notice how smooth it goes on the line.



Indicated advantages of Nicolet Light Weight Asbestos Pipe Line Felt:

1. More coating and wrapping machine travel without changing rolls.
2. Lighter, tightly wound rolls save approximately one-half the freight.
3. Flexibility permits tighter application on the enamel, better enamel penetration and keying-on-action.
4. Less enamel loss and patching because of longer travel without changing rolls.

WE ALSO HAVE
No. 1 — Nicolet Regular 15#
No. 2 — Nicolet Perforated 15#

For the finest in Asbestos Pipe Line Felt . . . in all weights

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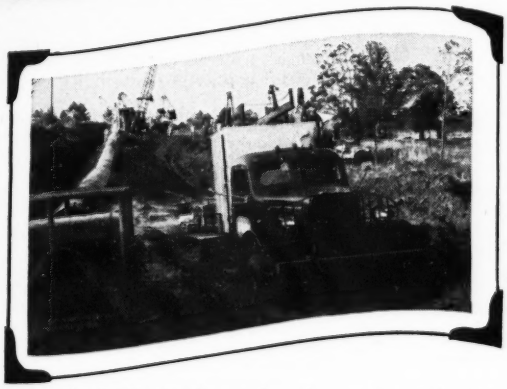
HERE IS OUR ANSWER TO MORE EFFICIENT PIPELINE WELD CONTROL!



Typical of all pipeline jobs, the going got real rugged on this one. That is one of the reasons why Industrial X-Ray Engineers were chosen to do the weld X-Ray. With the equipment, organization and men to surmount the most difficult terrain and problems, Industrial once again proves it is the leader in pipeline weld X-Ray.

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This complete darkroom mounted on a specially equipped truck allows immediate development of the film and interpretation of the weld X-Ray moments after the weld is completed with no loss of construction time. Industrial has the accumulated know-how and experience to provide far better weld control on *any* job, *any* where, *any* time!

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Pipe Coating Equipment & Materials

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- **MEDCO COATING FAULT LOCATORS** for underground coating inspection
- *Distributors for* **GULF-SEAL PIPE COATING GULF-SEAL ROCK SHIELD**
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MIDWEST PIPELINE SERVICE CO.

3946 W. 69th Terr.
Kansas City 15, Missouri

miles of 16-in. line from Utica to Amsterdam, N. Y.; 20 miles of 20-in. from Cayuta Gate to Ithaca, N. Y.; 20 miles of 20-in. line from Angelica to Rossburg, N. Y.; and 17 miles of 16-in. from Colesburg Junction to Sabinsville, Pa.

NORTHEASTERN GAS TRANSMISSION CO., Springfield, Mass. 1952 construction plans include 100 miles 16-in. from Greenwich, Conn. to Springfield, Mass.; 23 miles 4-in. from Granville, Mass. to Torrington, Conn.; 26 miles 6-in. from Framingham to Fitchburg, Mass.; 45 miles of 8-, and 4-in. from Lowell, Mass. to Concord, N. H. and 15 meter stations.

OHIO FUEL GAS CO., Columbus. Docket G-1862 for 31.2 miles of line in central Ohio, extending from Treat compressor station in Licking county to Weaver storage compressor station in Richland county. Ohio Pipe Line Construction Co., Granville, Ohio, is laying 23 miles of 20-in. north of Mt. Vernon.

OKLAHOMA NATURAL GAS CO., Tulsa. Trojan Construction Co. laying 25 miles of 12-in. line from Ringwood field to a junction near Enid, Okla.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1709 for a 44-mile, 8⅝-in. line in Monterey county, Calif.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo., has Midwestern Constructors at work on two 2000 hp units at Edgerton, Ind.

SOUTHERN UNION GAS CO., Dallas, has Foutz & Bursum Construction Co. at work on 20.5 miles of 20-in. line in the Star Lake region between Farmington and Albuquerque, N. M., and 20 miles of 8-in. in the Blanco area.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Brown & Root Inc. building 9 compressor stations and microwave communications system from Shreveport to Linden, N. J. and Anderson Bros. at work on 150 miles of 30-in. line from Wheelersburg, Ohio, to Powhatan Point, Ohio, and 66 miles of line from Uniontown, Pa., to Moundsville, W. Va., with Parkhill Truck Co. stringing the job. Anderson Bros. also has five spreads at work on 217 miles of 30-in. from Portsmouth, Ohio, to Connellsville, Pa. H. C. Price Co., Bartlesville, has a spread working eastward on the line from Texas Eastern's crossing on the Ohio river and a second spread at Woodsfield, Ohio, working westward from the Ohio river.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston, has Collins Construction Co. on 26-in. submarine crossing of Hudson between Staten Island and Brooklyn and lowering of present 26-in. line across Hudson river at 234 St., New York City.

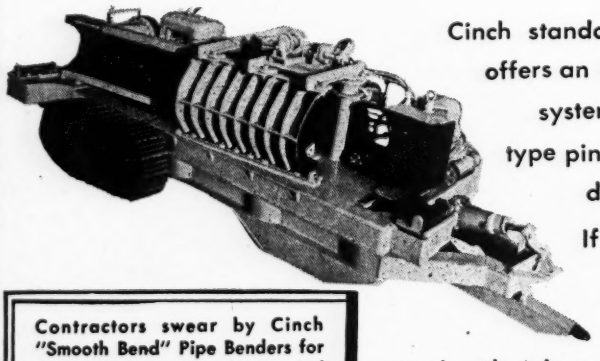
UNITED GAS PIPE LINE CO., Shreveport. River Construction Co. at work on 86.1 miles of 30-in. from Refugio county to near Wharton county, Texas, including a multiple river crossing of the Guadalupe river. Gulf Southern Contractors at work on 1017 miles of 6- to 30-in. line in Texas, Louisiana, and Mississippi and offshore in the Gulf of Mexico; Brown and Root at work on 5 compressor stations and 6 dehydration plants in the above states; Pittsburgh-Des Moines Steel Co. at work on suspension crossings over Colorado, Brazos, and Red rivers; Massey Pipe Line Construction Co. is laying 16 miles of 20-in. near San Antonio. Also 24 miles of gathering lines and measuring facilities to connect the Agua Dulce field with a plant in Nueces county, Texas.

UNITED GAS PIPE LINE CO., Shreveport, 39 miles 16-in. from Baldwin county, Ala., to Escambia county, Fla.; two laterals to Saufley field. Also tap and sales meter stations.

WISCONSIN PUBLIC SERVICE CORP., Milwaukee, has under way a 20-mile 2- to 12-in. pipeline. Gabe's Construction Co., Sheboygan, is the contractor.

CINCH

Affords Faster, Smooth Bends



Cinch standard equipment now offers an improved hydraulic system and new wedge-type pin-up slide for greater durability and speed. If desired, even faster, easier maneuvering can be obtained with Athey tracks and hydraulic lift tongue.

Contractors swear by Cinch "Smooth Bend" Pipe Benders for dependability and uninterrupted service. Cinch Pipeline Equipment provides the most up-to-date equipment and expert maintenance.

PIPE BENDERS LINE-UP CLAMPS

CINCH
PIPELINE EQUIPMENT, Inc.

7050 Long Drive
Houston 17, Texas
Milby 2484

Pending Construction

IOWA-ILLINOIS GAS & ELECTRIC CO., Davenport. Docket G-1721 for a 41-mile, 10-in. line from Washington county to Cedar Rapids, Iowa. Construction to begin third quarter of 1952.

KANSAS-NEBRASKA NATURAL GAS CO., Hastings. To build in Nebraska 20 miles of 6⅝-in. and 19 miles of 4½-in. from Neligh to O'Neill; 22 miles of 6⅝-in. and 34½ miles of 4½-in. from Neligh to Hartington; 52 miles of 3½-in. and 28½ miles of 2⅜-in. laterals.

LAKE SHORE PIPE LINE CO., Cleveland, Ohio, 45-mile, 10¾-in. line from Meadville, Pa. to Ashtabula, Ohio. Work to begin in 1952.

MISSISSIPPI RIVER FUEL CORP., St. Louis. Docket G-1581 for development of Waterloo, Ill. storage field, 16.2 miles of line, an 1800-hp station, and other facilities.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh, Pipe Line Construction & Drilling Co. for 23½ miles of 16- and 20-in. line from Preston station near Waynesburg, Pa. to Colvin Gate, Washington county, Pa., John D. Fahey on 4½ miles of 20-in. from Murrysville Gate to Tonkin pump station, Westmoreland county, Pa.

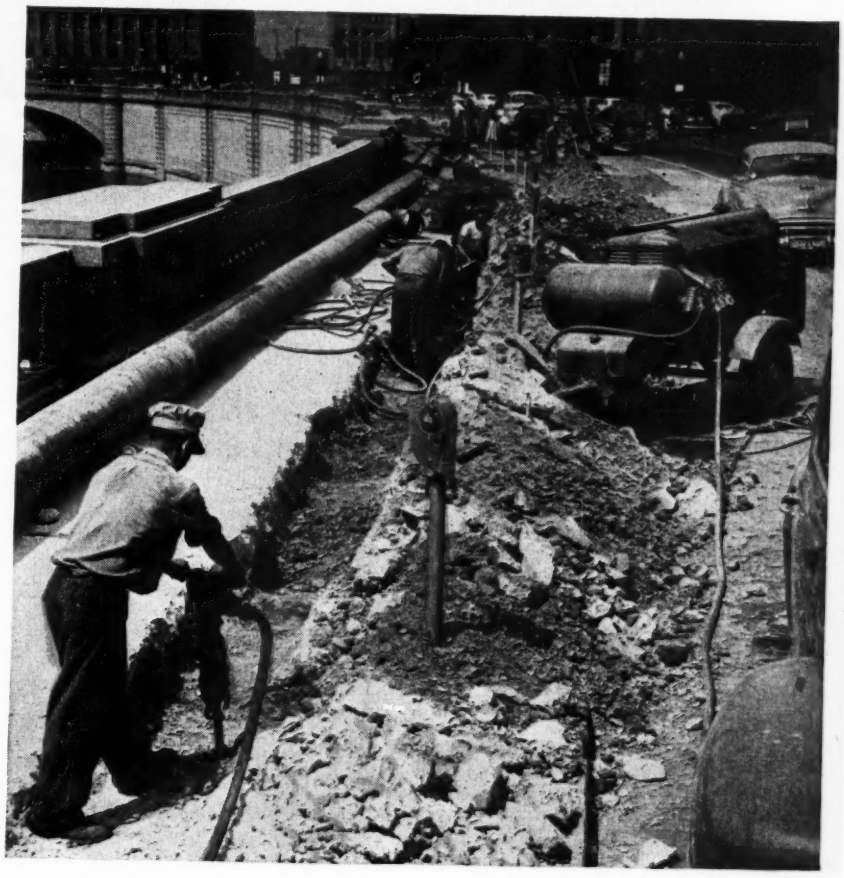
NIAGARA MOHAWK POWER CORP., Syracuse, under Docket G-1475, a 55-mile 10¾-in. line to supply Watertown and other communities. Contract awarded Williams-Austin Co. Project delayed due to steel pipe shortage.

TENNESSEE GAS TRANSMISSION CO., Houston, 521 miles of looping along present system; 420 miles, 30-in., Texas, Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky, and 101 miles 26-in., Kentucky and Ohio.

TEXAS GAS TRANSMISSION CORP., Owensboro. Modern Welding Co. will begin construction of 2 mile, 10-in. line near Madisonville, Ky., in June.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1843 to build an 11.3 mile line in Terrebonne parish, La.

any 2-breaker job moves faster with 125 cfm of air



Because 125 cfm of 100 lb. air maintains full pressure behind the heavy breakers, trench for this bridge crossing was actually dug 40% faster than it could have been done with any "old standard" 105 ft. compressor.

You get comparably increased production on other work, and from any Jaeger "Air Plus" rating, from 75 cfm for one breaker, up to 600 cfm for 2 heavy wagon drills. Ask your Jaeger distributor or send for Catalog JC-1.

JAEGER new standard "air plus" COMPRESSORS

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PUMPS • MIXERS • HOISTS • PAVING MACHINERY

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Hot Applied Pipe Line Coatings

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Protective Coatings for Pipe Joints

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PIPE WRAP

holds larger quantities of enamel on pipe . . . is not subject to deterioration thereby providing longer life for protective coating.

Call MAVOR for your next order of Corrosion Prevention Products.

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T. F. P. KELLY

HOUSTON 2, TEXAS

PIPELINE PEOPLE

H. F. Trusler

Appointment of H. F. TRUSLER JR. as technical sales representative, synthetic base coatings, has been announced by Pittsburgh Coke & Chemical Co. Mr. Trusler will be responsible for directing and coordinating sales, production, technical service, and development activities of synthetic coatings. Prior to joining Pittsburgh Coke & Chemical, he was engaged in technical sales activities with Stoner-Mudge Inc. Mr. Trusler will headquarter in Pittsburgh.

Midwestern Engine & Equipment Co., Tulsa, has named FRED J. STEINMILLER to handle the firm's pipeline wrapping and supply items in Indiana, Illinois, Iowa, Wisconsin, and Minnesota. He will headquarter in Chicago, a newly established Midwestern branch. The company, which has sales representation in six other areas, has also announced plans for construction of a $100,000 home office near Tulsa.

F. J. Steinmiller
Midwestern

A. E. Gray
Pittsburgh Coke

ARTHUR E. GRAY has been appointed assistant manager of tar base coatings by the Pittsburgh Coke & Chemical Co. He was previously vice president and sales manager of Pipe Protection Service Inc., and prior to that was associated with the Barrett Division, Allied Chemical & Dye Corp., as eastern sales supervisor for protective coatings.

P. A. GASS, superintendent of pipelines for Northern Natural Gas Co., Omaha, has been elected vice president in charge of personnel. Mr. Gass has been in the Omaha office for the past 12 years and prior to that spent 10 years in field work for the company. W. B. HAAS, formerly assistant superintendent of pipelines, succeeded Mr. Gass. In turn, Mr. Haas was succeeded by P. T. MCDONOUGH, former pipeline division superintendent at Ogden, Iowa. The Ogden position was filled by C. S. TONSFELDT, who had held a similar position at Clifton, Kan., and the vacancy at Clifton was filled by RALPH COTTON, a district foreman from South Omaha, Neb.

ARTHUR R. BLOTTER has been appointed chief accountant for New York State Natural Gas Corp., Pittsburgh. He has been with the company and Peoples Natural Gas Co., an affiliate, since 1938. JAMES G. BERGMAN JR. has been appointed cashier of New York State Natural.

Texas Eastern Transmission Corp., Shreveport, has granted a leave of absence to E. A. KOENIG, general superintendent, to enable him to accept a one-year appointment as chief of the gas transmission branch, gas operations division, PAD. H. M. MCDONALD, superintendent of pipelines, will act as general superintendent during Mr. Koenig's absence.

E. A. Koenig
Texas Eastern

H. E. Boynton
Tube Turns

Tube Turns of Canada Ltd., an affiliate of Tube Turns Inc., Louisville, Ky., has announced the appointment of HARRY E. BOYNTON as district manager for western Canada. He will headquarter in Edmonton. Mr. Boynton has been associated with the company since December 1951.

Master Tank & Welding Co. has expanded its headquarters offices in Dallas and has added several employees. A. V. MCMURRAY has been transferred from Tulsa to Dallas. C. L. YOUNG, assistant manager, now has charge of the Hi-Test expanded line pipe division, and TEX GUIDRY has rejoined the Dallas sales department after a period of absence.

NEW PRODUCTS

Protective Wrapping

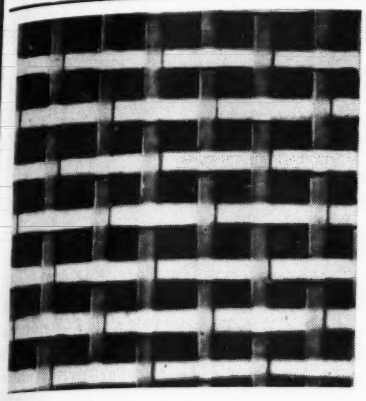
A new glass-base pipe hand-wrapping material has been designed to eliminate carrying hot dope from one wrapping job to the next. A protective coating of plasticized coal tar enamel prefabricated with a woven glass fabric which acts as carrier and reinforcement for the paint, it is easily applied by "flashing" with a low temperature torch, causing the enamel in the material to melt.

According to the manufacturer, Protecto Wrap provides an even, corrosion-resistive coating. Exposed strands will not carry moisture into the wrap, and the glass will not "wick out" the protective fractions of the coating.

Designed to give the standard 3/32-in. coating when 50% overlap is used, Protecto

Wrap is supplied in widths from 2-in. to 24-in. and is interwound with a paper separator that insures even distribution of the coating and easy unwinding regardless of temperature.

Model: Protecto Wrap.
Midwestern Engine & Equipment Co. Inc., Tulsa, Okla.

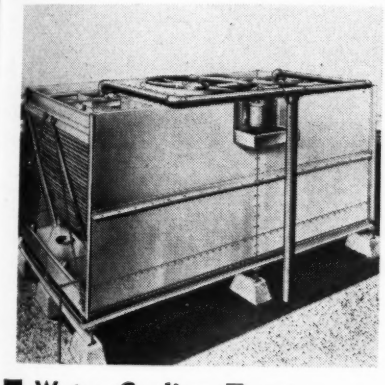


Pipe Wrap

Now on the market is an open weave fabric for the protective covering of pipes, constructed of Fiberglas yarn and possessing good tensile strength although its weight is a fraction of that of many coatings. A 300-ft roll 36 in. wide weighs only 9.5 lb. The fabric is produced in widths from 2-in. to 45-in. and in rolls of from 50 to 500 yards.

It eliminates cracking by holding waterproofing materials in uniform suspension and is not subject to "wicking" or other types of deterioration, according to the manufacturer. One of the advantages claimed for the product is a flexibility which permits tight application to uneven contours.

Model: Glasfab.
Twinsburg-Miller Corp., Twinsburg, Ohio.



Water Cooling Tower

Designed to simplify maintenance by having all parts readily accessible, a new cooling tower is now in production. It is available in seven standard sizes, from a 50-ton unit, in either all steel or wood with asbestos cement board casing.

Its features include reduced height, extremely low horsepower requirement for fan and pumping head, a single fan utilizing air from two open sides, and evenly distributed tower weight over a wider area.

Model: Double-Flow Aquatower.
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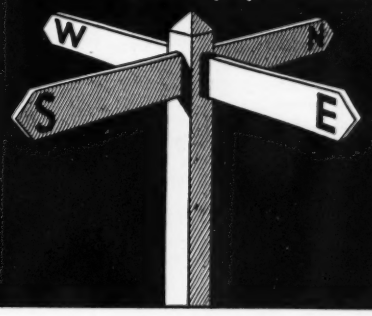

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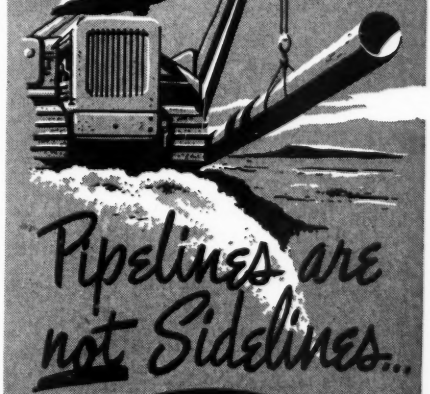

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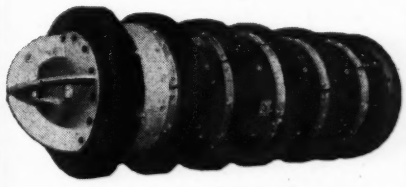

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Transmission Safety Group Reports Year's Progress

The natural gas transmission industry, striving for greater safety through individual company efforts, today has a unified working front in its fight for accident prevention. It is the Natural Gas Transmission Safety Assn., organized only a year ago and now coming into stature as a safety "clearing house" for the major gas transmission companies.

Until now, association spokesmen point out, there has been no measuring stick within the industry for determining the safety progress made or for controlling accidents. While the organization's constitution has not been ratified in final form, objectives have been crystalized:

"The NGTSA shall exchange ideas and practices for the prevention of accidents, devise means to encourage employees in the practice of safety principles at work and at home, conduct surveys and prepare studies of safety practices of other companies or industries, and otherwise further the cause of safety by whatever means possible."

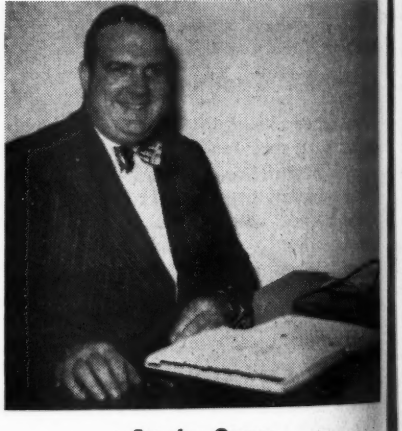
Membership is open to representatives of all natural gas transmission companies.

First efforts toward organization of safety representatives of the major transmission companies began late in 1950, and the initial meeting was held in Wichita, Kan. in February 1951. A second meeting was held in Amarillo last summer and the third was conducted in Shreveport on March 12-13 of this year.

One of the objectives of the group is to arrive at a standardized form of accident prevention report by company safety departments to company management. The year-end report of Stanley Owens, director of safety for Transcontinental Gas Pipe Line Corp., Houston, was presented at the Shreveport meeting and was judged outstanding. It will be presented by Mr. Owens at the AGA Accident Prevention Committee meeting in Cincinnati, to be held May 19-20.

Chairman of the association is Tom J. O'Donnell, El Paso Natural Gas Co.; vice chairman is R. E. Hill, Cities Service Gas Co.; and secretary is R. L. Matheson, Panhandle Eastern Pipe Line Co.

The association now has a membership representing 11 companies and officers expect to have representatives from 15 companies before the end of 1952.



Stanley Owens
Transco's safety director